Annals of Otology, Rhinology and Laryngology

FOUNDED BY JAMES PLEASANT PARKER

INCORPORATING

THE INDEX OF OTOLARYNGOLOGY

L. W. DEAN, M. D., Editor-in-Chief
Iowa City, Iowa

ARTHUR W. PROETZ, M. D., Associate Editor
Beaumont Building, St. Louis

EDITORIAL BOARD

J. C. BECK, M. D., Chicago; T. MELVILLE HARDIE, M. D., Chicago; G. L. RICHARDS, M. D., Fall River; THOS. J. HARRIS, M. D., New York; J. L. GOODALE, M. D., Boston; CLEMENT F. THEISEN, M. D., Albany; GEO. B. WOOD, M. D., Philadelphia; WYATT WINGRAVE, M. D., London; JOHN SENDZIAK, M. D., Warsaw; W. POSTHUMUS MEYJES, M. D., Amsterdam; N. RH. BLEGVAD, M. D., Copenhagen; EMIL MAYER, M. D., New York; A. J. BRADY, M. D., Sydney; S. CITELLI, M. D., Catania; H. J. B. DAVIS, M. D., London; ALBERT GRAY, M. D., Glasgow; H. B. HITZ, M. D., Milwaukee; IRA FRANK, M. D., Chicago; R. H. SKILLERN, M. D., Philadelphia; J. A. STUCKY, M. D., Lexington, Ky.; T. HOSHINO, M. D., Chicago.

PUBLISHED QUARTERLY
BY THE ANNALS PUBLISHING CO.
5154 Westminster Place
ST. LOUIS, MO., U. S. A.

SUBSCRIPTION PRICE, $6.00 PER ANNUM, IN ADVANCE.
Subscription price in Canada, $6.40.
Subscriptions in other countries of the Postal Union, $6.80.
Entered at the Postoffice, St. Louis, Mo., as Second-class Matter.

TABLE OF CONTENTS.

I.—Demonstration of the Principles of Talking and Hearing With Application to Radio. By HARVEY FLETCHER, M. D., of the Bell Telephone Laboratories, New York 1

II.—The Physics of Sinus Drainage. By ARTHUR W. PROETZ, M. D., St. Louis 23

III.—Diagnosis of Nasal Sinus Disease. By EDWARD KING, M. D., Cincinnati 34

IV.—Cicatricial (Benign) Stricture of the Esophagus: Tabulated Report of One Hundred Eighty-six Cases. By PORTER P. VINSON, M. D., Section on Medicine, Mayo Clinic, Rochester, Minn 40

V.—The Esophagus in Pott's Disease and Scoliosis. By LEROY A. SCHALL, M. D., from the Department of Laryngology, Harvard Medical School, Boston 57

VI.—Gummatous Stenosis of the Trachea: Report of a Case. By ROBERT M. LUKENS, M. D., Philadelphia 72

VII.—The Treatment of Antral Disease by Simple Tube Drainage. By R. E. MERCER, M. D., Detroit 81

VIII.—Some Observations on Sinus Disease in Private Practice. By GORDON F. HARKNESS, M. S., M. D., Davenport, Iowa 89

IX.—The Older Methods for Testing Hearing. By GEORGE W. MACKENZIE, M. D., Philadelphia 100

X.—Cerebrospinal Fistula Following Ethmoidectomy: Recovery. By ARTHUR M. ALDEN, A. M., M. D., St. Louis 121

XI.—X-Ray Injury to the Larynx With Report of a Case. By SAMUEL IGLAUER, M. D., Cincinnati 124

XII.—The Advantages and Disadvantages of the Proximally Illuminated Bronchoscope. By SIDNEY YANKAUER, M. D., New York 133

XIII.—Atrophic Rhinitis: Some Findings in a Series of Eighty Cases. By GORDON D. HOOPLE, M. D., Syracuse, and A. W. ROWE, PH. D., Boston 144

medical
Wahr

XIV.—Some Observations on Auditory Canal Infections. By DUNBAR ROY, A. B., M. D., Atlanta....177

XV.—The Intratracheal Injection of Lipiodol Through the Cricothyroid Membrane: A Description of the Instrumentarium and Technic. By JEROME R. HEAD, M. D., Chicago....183

XVI.—Coagulation Time Prior to Tonsillectomy. WESTLEY M. Hunt, M. D., New York....187

XVII.—The Anatomic, Pathologic and Clinical Relationship of the Posterior Sinuses to Optic Neuritis. By CLAUDE G. CRANE, M. D., Brooklyn....201

XVIII.—Treatment of Atrophic Rhinitis by Ivory Implants: Presidential Address. By HARRY L. POLLOCK, M. D., Chicago....241

XIX.—Address of the President, American Bronchoscopic Society, 1926. By WILLIAM B. CHAMBERLIN, M. D., Cleveland....248

XX.—Bronchoscopy in the General Hospital. By M. C. MYERSON, M. D., Associate Laryngologist, Mt. Sinai Hospital, New York....253

XXI.—Bronchoscopic Pharyngeal Suction Tube. By M. C. MYERSON, M. D., New York....259

XXII.—A New Esophageal Bougie. By M. C. MYERSON, M. D., New York....261

XXIII.—Multiple Cysts of the Lung. By WILLIAM FREDERIC MOORE, M. D., Philadelphia....263

XXIV.—Continuous Endobronchial Aspiration for Drowned Lung Complicating Eclampsia. By WILLIAM F. MOORE, M. D., Philadelphia....270

XXV.—Bronchoscopic Lipiodol Instillation Tubes. By GABRIEL TUCKER, M. D., Philadelphia....272

XXVI.—A Bronchoscopic Bead Forceps. By GABRIEL TUCKER, M. D., Philadelphia....274

XXVII.—Report of Two Cases of an Open Safety Pin in the Trachea. By HENRY HALL FORBES, M. D., New York..276

XXVIII.—Report of Three Cases: (a) Fibroma of the Left Bronchus; (b) Ulcer of the Right Bronchus; (c) Foreign Body in the Trachea and Right Bronchus. By WAITMAN F. ZINN, M. D., Baltimore....278

XXIX.—Report of a Case of Cyst of the Thyroglossal Duct. By E. G. Gill, M. D., Roanoke, Va.....283

XXX.—Focal Infection From the Dental Standpoint. By Earle C. Rice, D. D. S., Philadelphia.....285

XXXI.—Further Data on the Displacement Method in Sinuses. By Arthur W. Proetz, M. D., St. Louis.....297

XXXII.—Thrombosis of the Superior Longitudinal or Straight Sinus by Extension from the Lateral Sinus: Report of Three Cases. By Harold I. Lillie, M. D., Section on Otology and Rhinology, Mayo Clinic, Rochester, Minn.....324

XXXIII.—Modern Facilities in the Diagnosis and Localization of Brain Lesions: Their Importance to the Ophthalmologist and Otologist (Lantern Slides). By E. R. Carpenter, M. D., Dallas.....332

XXXIV.—Polypoid Tissue in Maxillary Antra: X-Ray Diagnosis. By William Francis Drea, D. M. D., Colorado Springs.....341

XXXV.—Herpes Zoster Oticus. By William Hardin Sears, M. D., Huntingdon, Pa.....361

XXXVI.—Recent Vaccine Therapy in Otolaryngology. By Ralph A. Fenton, M. D., Portland, Oregon.....387

XXXVII.—Vaccinotherapy in Otolaryngology. By Judson Daland, M. D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania, Philadelphia.....404

XXXVIII.—A Rhinologic Study of Bronchial Asthma. By Vernon L. Bishop, M. D., Rochester, N. Y.....410

XXXIX.—Unusual Types of Mastoiditis, With Presentation of Patients. By S. MacCuen Smith, M. D., Philadelphia..439

XL.—Sudden Edema of the Larynx, Especially After Childbirth. By Wolff Freudenthal, M. D., New York.....448

XLI.—Recent Literature on Cranial Resonance and Its Clinical Application. By Robert Sonnenschein, M. D., Chicago.....454

XLII.—The Use of Foreign Bodies in Ear, Nose and Throat Surgery. By Harry L. Pollock, M. D., Chicago.....463

XLIII.—Tracheotomy and Intubation. By Harry L. Baum, M. D., Denver.....472

XLIV.—Pterygomaxillary Abscess Complicating Acute Mastoiditis. By JEROME L. STRAUSS, M. D., Chicago.....477

XLV.—The Nasal Accessory Sinuses in Cardiopathies: Report of Cases. By JOSEPH W. MILLER, M. D., New York....483

XLVI.—The Ear, Nose and Throat, in Its Relations to General Medicine. By A. HARRY RUBENSTEIN, M. D., Syracuse, N. Y. 489

XLVII.—Scarlet Fever Otitis: A Report of Sixty-six Cases. By ANNA B. LEFLER, M. D., Los Angeles.....495

XLVIII.—Reflections on the Hazards of Nasal Surgery in the Person With Senile Changes. By FREDERICK T. HILL, M. D., Waterville, Me.....503

XLIX.—A Clinical Consideration of Inflammations and Infections of Extratonsillar Pharyngeal Lymphoid Tissue Before and After Tonsillectomy. By V. V. WOOD, M. D., St. Louis 511

L.—In Memoriam. Charles Moore Robertson, M. D., 1865-1926. By OTTO STEIN, M. D., Chicago.....552

LI.—Theories of Sound Analysis and Intensity Control on the Basis of Middle and Inner Ear Mechanics. By A. G. POHLMAN, M. D., Professor of Anatomy, St. Louis University, St. Louis 579

LII.—Otitis Media in Infants. By DEAN M. LIERLE, M. S., M. D., Iowa City, Iowa.....604

LIII.—Tuberculosis of the Middle Ear, With Especial Reference to Heliotherapy. By S. J. CHAPMAN, M. D., Colorado Springs 631

LIV.—Correction of Pronounced Types of Saddle Nose With Mixed Implants of Bone and Cartilage. By LEE COHEN, M. D., Baltimore 639

LV.—Injection of the Nasal Ganglion and Comparison of Methods. By GREENFIELD SLUDER, M. D., St. Louis.....648

LVI.—The Rôle of Surgery in the Modern X-Ray Treatment of Cancer in the Larynx. By PROFESSOR GEORGES PORTMANN, Bordeaux.....656

LVII.—Osteitis Deformans and the Eye, Ear, Nose and Throat Specialties. By SHERWOOD MOORE, M. D., St. Louis..662

LVIII.—The Differential Diagnosis Between Septic Meningitis, Brain Abscess and Lateral Sinus Thrombosis Complicating Mastoiditis. By GEORGE W. SWIFT, M. D., Seattle.....669

LIX.—Case Report: Lateral Sinus Thrombosis With Delayed Metastasis. By RALPH A. FENTON, M. D., Portland, Oregon 675

LX.—Brain Abscess of Otitic Origin. By FREDERICK EMERSON HASTY, M. D., Nashville.....678

LXI.—Acute Mastoiditis With Complicating Facial Paralysis: Recovery After Operation. By ADOLPH GREENSTEIN, M. D., New York.....684

LXII.—Pediatric Aspects of Otolaryngology. By McKIM MARRIOTT, M. D., St. Louis.....686

LXIII.—Frontal Sinus Empyema in Young Children, With Several Case Reports. By IRVING MARTIN LUPTON, M. D., F. A. C. S., Portland, Ore.....693

LXIV.—Meningitis of Nasal Origin: A Study in Surgical Anatomy. By ROY F. NELSON, M. D., Oakland.....701

LXV.—Frontal Sinusitis Complicated by Extradural Abscess and Frontal Lobe Abscess. By J. MACKENZIE BROWN, M. D., Los Angeles.....710

LXVI.—Malignant Neoplasms of the Antrum. By GEORGE H. THOMPSON, M. D., North Adams, Mass.....715

LXVII.—Disease of the Ethmoid Labyrinth. By L. M. CALLAWAY, M. D., Kansas City, Mo.....733

LXVIII.—Tonsil Infection, With Report of Cases. By JAMES C. TUCKER, M. D., Beatrice, Neb.....748

LXIX.—Tuberculosis of the Respiratory Tract Viewed From the Immunity and Biologic Aspect. By DAVID NUSSBAUM, M. D., Philadelphia.....768

LXX.—Streptococcic Laryngitis: Report of a Case With a Very Rare Complication. By V. K. HART, M. D., Statesville, N. C.....781

LXXI.—Ophthalmic Contacts With Otolaryngology. By W. H. LUEDDE, M. D., St. Louis 786

LXXII.—Focal Infections of the Head. By E. E. POOS, M. D., Detroit.....798

LXXIII.—Nasal Manifestations of Allergy. By CHARLES H. EYERMANN, M. D., St. Louis.....808

LXXIV.—Trichloracetic Acid in the Treatment of Ulcerative Laryngeal Tuberculosis. By BERTRAM C. DAVIES, M. D., Los Angeles.....817

LXXV.—Allergy as Related to Otolaryngology. By W. W. DUKE, PH. B., M. D., Kansas City.....820

LXXVI.—Hyperesthetic Rhinitis and Myxedema. By FRANK J. NOVAK, JR., M. D., Chicago.....829

LXXVII.—Diagnostic Mistakes: A Plea for the Imperative Biopsy. By M. REESE GUTTMAN, B. S., M. D., Chicago.....837

LXXVIII.—Focal Infection and Elective Localization in the Pathogenesis of Diseases of the Eye. By EDWARD C. ROSENOW, M. D., Rochester, Minn.....883

LXXIX.—The Etiology of Focal Infection: Medical Aspects. By RUSSELL L. HADEN, M. D., Kansas City, Kans.....896

LXXX.—Otolaryngologic Phose of Focal Infection. By H. W. LYMAN, M. D., St. Louis.....903

LXXXI.—Mastoid Infection in the Infant. By GEORGE MORRISON COATES, A. B., M. D., Philadelphia.....913

LXXXII.—A Sermon. By Ross H. SKILLERN, M. D., Philadelphia 925

LXXXIII.—The Influence of Paranasal Sinus Infections in Infants and Young Children Upon Certain Systemic Conditions and the Influence of Certain Systemic Conditions in Infants and Young Children Upon the Method of Treating Coexisting Sinusitis. By L. W. DEAN, M. D., Iowa City.....933

LXXXIV.—The Varying Symptomatology of Chronic Maxillary Sinusitis, Depending on the Pathology Present. By FRANCIS P. EMERSON, M. D., Boston.....947

LXXXV.—The Relation of Pregnancy to Mastoid Infections. By HAROLD A. FLETCHER, M. D., San Francisco.....966

LXXXVI.—Visualization of Sinus Drainage. By ARTHUR W. PROETZ, M. D., St. Louis.....978

LXXXVII.—Paranasal Sinusitis: A Clinical Consideration. By JOHN J. SHEA, M. D., Memphis.....991

LXXXVIII. — Differentiation Between Ophthalmic and Sinus Headaches. By RALPH A. FENTON, M. D., Portland, Oregon 1000

LXXXIX. — Suppurative Labyrinthitis With Report of Cases. By GEORGE W. MACKENZIE, M. D., Philadelphia.... 1019

XC.—Early Metastasis in a Tumor of the Vocal Cords. By ARTHUR E. HERTZLER, M. D., Halstead, Kans..... 1078

XCI.—Observations on the Treatment of Hay Fever in the Pacific Northwest: Fifty-three Cases. By CHARLES T. CHAMBERLAIN, M. D., Portland, Ore..... 1083

XCII.—Experimental Work With the Bacillus Pyocyaneus: Report of a Case of Pyocyanic Stomatitis With Agranulocytic Leukopenia. By FREDERICK H. LINTHICUM, M. D., Los Angeles 1093

SOCIETY PROCEEDINGS..... 288, 555, 843, 1104

Philadelphia Laryngological Society..... 572

Middle Section American Laryngological Society..... 843

American Otologic Society..... 1104

American Bronchoscopic Society 1122

Chicago Laryngological and Otological Society.... 288, 555, 560, 867, 1181

VOL. XXXVI MARCH, 1927 No. 1

Annals of Otology, Rhinology and Laryngology

FOUNDED BY JAMES PLEASANT PARKER

INCORPORATING

THE INDEX OF OTOLARYNGOLOGY

H. W. LOEB, M. D., Editor-in-Chief

1402 South Grand Blvd., St. Louis

EDITORIAL BOARD

J. C. BECK, M. D., Chicago; T. MELVILLE HARDIE, M. D., Chicago; G. L. RICHARDS, M. D., Fall River; THOS. J. HARRIS, M. D., New York; J. L. GOODALE, M. D., Boston; CLEMENT F. THEISEN, M. D., Albany; GEO. B. WOOD, M. D., Philadelphia; WYATT WINGRAVE, M. D., London; JOHN SENDZIAK, M. D., Warsaw; W. POSTHUMUS MEYJES, M. D., Amsterdam; N. RH. BLEGVAD, M. D., Copenhagen; EMIL MAYER, M. D., New York; A. J. BRADY, M. D., Sydney; S. CITELLI, M. D., Catania; H. J. B. DAVIS, M. D., London; L. W. DEAN, M. D., Iowa City; ALBERT GRAY, M. D., Glasgow; H. B. HITZ, M. D., Milwaukee; IRA FRANK, M. D., Chicago; R. H. SKILLERN, M. D., Philadelphia; J. A. STUCKY, M. D., Lexington, Ky.; T. HOSHINO, M. D., Chicago.

PUBLISHED QUARTERLY

BY THE ANNALS PUBLISHING CO.

5154 Westminster Place

ST. LOUIS, MO., U. S. A.

SUBSCRIPTION PRICE, $6.00 PER ANNUM, IN ADVANCE.

Subscription price in Canada, $6.40.

Subscriptions in other countries of the Postal Union, $6.80.

Entered at the Postoffice, St. Louis, Mo., as Second-class Matter.

CONTENTS

I.—Demonstration of the Principles of Talking and Hearing With Application to Radio. By Harvey Fletcher, M. D., of the Bell Telephone Laboratories, New York....1

II.—The Physics of Sinus Drainage. By Arthur W. Proetz, M. D., St. Louis....23

III.—Diagnosis of Nasal Sinus Disease. By Edward King, M. D., Cincinnati....34

IV.—Cicatricial (Benign) Stricture of the Esophagus: Tabulated Report of One Hundred Eighty-six Cases. By Porter P. Vinson, M. D., Section on Medicine, Mayo Clinic, Rochester, Minn....40

V.—The Esophagus in Pott's Disease and Scoliosis. By LeRoy A. Schall, M. D., from the Department of Laryngology, Harvard Medical School, Boston....57

VI.—Gummatous Stenosis of the Trachea; Report of a Case. By Robert M. Lukens, M. D., Philadelphia....72

VII.—The Treatment of Antral Disease by Simple Tube Drainage. By R. E. Mercer, M. D., Detroit....81

VIII.—Some Observations on Sinus Disease in Private Practice. By Gordon F. Harkness, M. S., M. D., Davenport, Iowa....89

IX.—The Older Methods for Testing Hearing. By George W. Mackenzie, M. D., Philadelphia....100

X.—Cerebrospinal Fistula Following Ethmoidectomy; Recovery. By Arthur M. Alden, A. M., M. D., St. Louis....121

XI.—X-Ray Injury to the Larynx With Report of a Case. By Samuel Iglauer, M. D., Cincinnati....124

XII.—The Advantages and Disadvantages of the Proximally Illuminated Bronchoscope. By Sidney Yankauer, M. D., New York....133

XIII.—Atrophic Rhinitis: Some Findings in a Series of Eighty Cases. By Gordon D. Hoople, M. D., Syracuse, and A. W. Rowe, Ph. D., Boston....144

XIV.—Some Observations on Auditory Canal Infections. By Dunbar Roy, A. B., M. D., Atlanta....177

XV.—The Intratracheal Injection of Lipiodol Through the Cricothyroid Membrane. A Description of the Instrumentarium and Technic. By Jerome R. Head, M. D., Chicago....183

XVI.—Coagulation Time Prior to Tonsillectomy. Westley M. Hunt, M. D., New York....187

CONTENTS—Continued on Third Cover Page.

ANNALS
OF
OTOLOGY, RHINOLOGY
AND
LARYNGOLOGY

INCORPORATING THE INDEX OF OTOLARYNGOLOGY.

VOL. XXXVI. MARCH, 1927. No. 1.

I.

DEMONSTRATION OF THE PRINCIPLES OF TALKING AND HEARING WITH APPLICATION TO RADIO.*

BY HARVEY FLETCHER, M. D.,

OF THE BELL TELEPHONE LABORATORIES,

NEW YORK.

This joint meeting of the medical, musical, physical and engineering societies is rather significant. As far as I know, it is one of the first of its kind that has been held. It seems to me that a great mutual benefit would result if more gatherings of this kind were possible, where things of common scientific interest could be discussed. During the past two or three years there has been a good beginning made in the cooperation between physicists, electrical engineers and men from the medical profession, as is witnessed by the work being done by Dean and Bunch, Fowler and Wegel, Wilson and Minton, Jones and Knudsen, Pohlman and Kranz, and others.

It is my purpose to present some of the important facts concerning the process of speaking, the physical forms of speech

*Lecture and demonstration given before a joint meeting of the American Institute of Electric Engineers and the American Laryngological, Rhinological and Otological Society at Boston, January 24.

waves while they are being transmitted through the air, and then the effect upon the interpretation given by the ear of changes in these wave forms, either in shape or in magnitude. I also desire to discuss the mechanism of hearing and the effect upon the pitch and quality of musical tones due to the faulty transmission of the sounds to the ear. Some of the material may be somewhat elementary to the doctors who are here, but may be new to the engineers, and also some of the material may be somewhat elementary for the engineers, but new to the doctors, and I hope that part of the material will be new and interesting to all groups present.

First let us consider the mechanism of speaking. The organs of speech are the lungs, which by their bellowslike action supply the streams of air which pass in and out through the vocal passages, the vocal cords, the tongue, the lips and the cavities of the nose and throat. These impress on the air streams variations which are heard as speech sounds. In Fig. 1 is shown a cross section of a human head, giving the relative positions of these various organs. The vocal cords are a pair of muscular ledges on both sides of the larynx, forming a straight slit, through which the breath passes. The vibration of these vocal cords starts a train of sound waves, which are conducted through the vocal passages. These passages impress upon it certain resonant characteristics, the vibrations finally emerging from the mouth as speech sounds. The socalled voiced sounds are produced in this manner. These include all the vowel and consonant sounds except *p, t, ch, k, f, s, th* (thin) and *sh*. The vocal cords do not enter into the production of the last mentioned speech sounds. They are produced by certain vibrations set up in the mouth itself.

The voiced sounds may be divided into two classes—those produced by a continuous flow of air, which may be called the continuants, and those produced by a sudden stoppage in the air passages, which may be called the stops. It will be noticed from Fig. 1 that there are two variable resonating cavities through which sounds from the vocal cords pass, namely, the throat, the mouth cavity, and also a third fixed cavity—the nasal. For this reason the speech sounds, called the continuants, are characterized by having their frequencies in two particular regions very much magnified. For example, if we

speak the sound $\bar{a}$ at various pitches, the fundamental frequency of this speech sound will vary, but it will be found that those harmonics near 560 cycles, and 2,000 cycles will be always greatly magnified, regardless of the pitch. It is largely these particular regions of resonance that distinguish it from other sounds. Similarly, the vowel $\bar{u}$ is characterized by the resonant regions 475 and 4,000, the vowel $\bar{o}$ by the resonant regions 600 and 3,500, and the vowel $\bar{e}$ by the resonant regions 300 and 2,500.

Some recent experience with persons who have lost their larynx through an operation has emphasized the fact that the differentiation of the speech sounds is largely accomplished by the mouth and lip positions and that the sounds from the vocal cords act only as a sort of carrier.

The surgical operation known as tracheotomy leaves no connection between the lungs and the mouth. It is performed usually in an emergency to prevent the patient from dying of suffocation. When a patient recovers from such an operation, the process of breathing is carried on by drawing the air in and out through a small opening in the neck. Consequently the patient can make no vocal sounds. If an attachment is made to the opening of the windpipe so that the patient can blow a whistle, such as is used in toy balloons, and the sound directed into the corner of the mouth, the patient can learn to talk again.

In cooperation with Dr. Mackenty of New York City and some of his patients, such a device has been developed in our laboratories. Some of the patients have learned to talk with the aid of this apparatus, so that they can be readily understood in a very good sized room. The quality is, of course, different from the human voice, but the speech is understandable. I have one of these artificial larynxes here and will try to imitate some of the common words. The bellows, which you see, will function in place of the lungs; the whistle, in place of the voice box; and the rubber tube, in place of the tracheal cavity. In order to make the words or sentences intelligible it will be necessary to correlate the movements of my foot with the changing shape of the mouth and throat cavities. This correlation is ordinarily done unconsciously by the muscles of breathing. [The use of the artificial larynx was

demonstrated by producing common words and sentences.] In Fig. 2 is shown a photograph of this larynx as used by a patient.

As the speech sounds radiate from the mouth they are transmitted through the air by means of pressure waves. These air vibrations are exceedingly tiny and complicated, since the cavities of the mouth and throat are continually varying in size, and the stream of air is constantly being interrupted in forming the consonants.

We have arranged an apparatus to pick up these small pressure waves and project them upon the screen. Briefly, it consists of a telephone transmitter, which picks up the sound waves and transforms them into their electrical counterpart. The electrical wave is then sent into an oscillograph and analyzed in the usual way by a revolving mirror. [A projection oscillograph apparatus was used to show the wave shapes of the vowel sounds and also several common phrases and sentences. A diagrammatic sketch showing the principles governing the operation of the apparatus is shown in Fig. 3.] In Fig. 4 is shown the wave form of the word "alters" obtained by an accurate laboratory oscillograph, which works on the same principle as the one used in the demonstration.

It is seen that although the speech sounds are formed in a seemingly simple way, the disturbances produced in the air are very complicated. As the conversation proceeds, not even the vowel sounds are sustained, either in pitch or intensity, except for very short intervals of time, but instead there is a continual change from one state to another. However, most of the speech sounds have certain pitch and loudness regions which are characteristic. A chart showing roughly the position of these characteristics for most of the speech sounds is given in Fig. 5.

It is seen from this chart that the transmission of these speech waves without distortion requires a system that transmits all vibration frequencies throughout a wide range and also one which will handle various amounts of energy throughout a very wide range. In other words, it must be a system which is not selective, either in frequency or intensity.

The free air fulfills this requirement very well, but air confined in rooms with reflecting walls or in tubes with connect-

ing chambers having various shapes and sizes is a very selective transmission medium, and when used for transmitting speech or music to the ear will produce very serious distortion. Similarly, free ether is free from distortion when transmitting electrical waves, but, as all the electrical engineers know, it is very difficult to keep the system free from selectivity, either in frequency or intensity, when the electrical waves are confined to wires to which are connected coils, condensers, tubes and other equipment which is necessary in a communication system.

The next demonstration will show you what will happen to the interpretation and the quality of the speech sounds when severe selectivity occurs. In cooperation with the local telephone people we have erected for our use tonight a high quality electrical transmission system. Variable electrical filters have been inserted into this system at appropriate places. By means of these filters all the vibration frequencies above a given limit or below a given limit can be eliminated. The indicator is arranged so that only those frequencies that are illuminated are being transmitted by the system, the others being filtered out. For example, when only the numbers below 1000 are illuminated the electrical transmission system is filtering out all vibration frequencies above 1000. By means of this experiment you will be able to determine those frequency regions that carry most of the energy and also those regions responsible for most of the interpretation. [In the demonstration it was shown that when the high frequencies were eliminated the consonant endings were missing. It was almost impossible to understand anything that was said when all the frequencies above 1000 cycles were eliminated. When all the frequencies below 1000 cycles were eliminated the speech sounded very unnatural but it was intelligible. The high frequencies are the most important for carrying intelligibility and the low frequencies for carrying the tone quality. For a complete discussion of this effect see the paper entitled "Nature of Speech and Its Interpretation," Jour. of Frank. Inst., June, 1922.]

Let us now consider the mechanism of hearing. This is usually divided into three parts, the outer, the middle and the inner ear. The outer ear includes the lobe, the ear canal and

the drum. The middle ear is a small hollow space containing the hammer, anvil and stirrup, three small bones which carry the vibrations from the drum to the inner ear. The inner ear is a spiral space in the bony shell which is filled with a fluid; it is called the cochlea. It is here that the auditory nerve terminals are situated. Attached to this cochlea are three tubular projections in planes at right angles. These constitute the semicircular canals and take no part in the hearing process, but give us the balancing sense.

In Fig. 6 a diagrammatic sketch of the ear is given. For simplicity, the inner ear is shown uncoiled. It is composed of two compartments separated by a narrow flexible membrane called the basilar membrane, except at the apex of the cochlea, where a small opening called the helicotrema connects them. The terminals of the auditory nerves are located along this membrane. When a sound vibration impinges upon the ear drum it is transmitted through the three bones of the middle ear to the oval window. Here it is transmitted to the fluid. If the pitch is very low the fluid is moved bodily back and forth around the dividing membrane, the motion at the round window being opposite in phase to that at the oval window—that is, the latter moves outward when the former moves inward, and the only motion imparted to the dividing membrane is near the small opening. Consequently only the nerve terminals in this vicinity are stimulated. For the very high pitches the reaction of the fluid is so great that most of the vibrational energy is transmitted through the membrane very near the oval window so that only the nerve terminals in this vicinity are stimulated. For pitches between these extremes the vibrational energy is transmitted through the membrane at different regions between these extremes, the position depending upon the frequency. For example, 1000 cycles is sensed by the nerve terminals located near the middle of this membrane. In Fig. 7 is shown the position on this membrane where the various frequencies are sensed, as plotted by Wegel and Lane.* It is seen that the first five millimeters of the membrane from the oval window are principally concerned with the interpretation of tones having frequencies above 5000, while

*Wegel, R. L., and Lane, C. E.: Phys. Rev., Feb., 1924, p. 279.

the last five millimeters are concerned with frequencies below 175.

It has been found that the transmitting mechanism of the inner ear is nonlinear in its response—that is, it acts toward transmission like an overloaded vacuum tube. For this reason, when loud complex tones are impressed upon it, due to the modulating effect of the middle ear, the frequencies producing the stimulations in the inner ear are quite different from those impressed upon the outer ear, so that the quality of a complex sound is dependent to a large extent upon the intensity at which it reaches the ear.

Due to this nonlinear property of the ear transmitting mechanism, when a pure loud tone—that is, one free from harmonics—is impressed upon the ear drum, a large number of harmonics of the tone are impressed upon the nerve terminals. For this reason not only are the particular nerve terminals in the region corresponding to the frequency of the pure tone stimulated but also those in the regions corresponding to the harmonics.

This is illustrated in Fig. 8, which shows the response amplitude of the dividing membrane for two tones impressed separately having frequencies of 400 and 1200 respectively. It will be seen that about one-half the length of the membrane is vibrating with sufficient amplitude to cause nerve stimulation when a single tone is impressed. It is evident that these parts of the membrane cannot be used for interpreting other sounds until the amplitude of the latter are greater than those shown. This is a conception of great importance to telephone and radio engineers. It shows just how and why extraneous noise interferes with the interpretation of speech. I think it will also give us a clearer picture of the physical basis of harmony.

It is evident now why it is that the presence of noise has the effect of making people temporarily deaf. Their ability to hear and interpret speech in such a noise is just the same as though they were hard of hearing.

With this mechanism of the ear in mind, it is easy to see what the masking effect of one tone upon another will be. A loud low tone will have a large number of subjective har-

monics, so that the entire length of the basilar membrane from the position of the 400 cycle note will be agitated. Consequently, all the tones higher than 400 will be masked, those nearest 400 most, and those farthest away least. This is true because any new tone which we try to hear through the 400 cycle note must be sufficiently loud to produce at any point on the membrane an agitation at least equal to that which is already there. Similar reasoning shows that the high tones, even though they are very loud, will not mask the low tones. This effect of the masking of one tone by another will be demonstrated. [In this demonstration a 400 cycle tone was generated by means of a vacuum tube oscillator and was projected into the room as a sound wave by means of a loud speaking telephone receiver. By means of a second vacuum tube oscillator and sound projector a second tone could be produced in the room, and its intensity varied by means of an electrical attenuator. The pitch of the second tone was made 1000 and its intensity reduced until the people in the audience could not hear it in the presence of the 400 cycle tone. The 400 cycle tone was then turned off, and everyone was surprised to hear the 1000 cycle tone sounding quite loudly. The procedure was then reversed, the 1000 cycle tone being the louder and the 400 cycle being reduced until it was no longer heard. Upon switching off the 1000 cycle tone it was found that the 400 cycle tone had been so reduced that it could no longer be heard, even though the 1000 cycle tone was switched off. In other words, this experiment showed that the presence of the 1000 cycle tone would not affect the threshold of the 400 cycle tone, but that the loud 400 cycle tone affected very appreciably the threshold of the 1000 cycle tone. Fig. 9 shows some quantitative results upon the effect of one tone masking another tone.

The frequencies of the two projected tones were then made equal by proper adjustments of the dials on the two vacuum tube oscillators and both amplified to be very loud. Then the frequency of one tone was gradually reduced. The first phenomenon to be noticed was the fluctuation in the intensity of the sound, known as beats. These beats became more rapid until the ear gradually recognized a third tone in addition to the two primary tones. The frequency of this tone corre-

sponded to the difference in frequency of the two primary tones. As the pitch of the second projected tone decreased, the pitch of the low difference tone gradually increased. If either of the primary tones were switched off, the low difference tone immediately disappeared. This difference tone is probably produced in the process of transmission of the two tones through the middle ear.]

It is evident that if a pure tone produces a series of harmonics in the ear, then when a musical tone which already has harmonics in it is impressed upon the ear, the situation is not materially altered. In other words, a musical tone with a string of harmonics does not produce a very greatly different sensation than a pure tone, for in both cases, when the sound arrives at the nerve terminals, the fundamental is accompanied by a series of harmonics. However, it is the relative intensity of these harmonics stimulating the nerve endings which determines the tone quality—that is, whether it is like a violin or piano or a musical tone from some other instrument. In Fig. 10 are shown the relative intensities of the harmonics in the air of the musical tone produced from the most commonly used instruments. It is seen that in general a musical tone of a given pitch has not only a vibration frequency corresponding to this pitch, but also a large number of frequencies, called harmonics, which are simple multiples of this fundamental frequency. What will happen to such musical sounds if part of the components are eliminated? If the upper harmonics are eliminated, you are all familiar with the fact that it changes the quality. Until recently we have not asked the question as to what will happen when you eliminate the lower portion. An actual experimental trial indicated that the elimination of the lower part of these components produces similar effects to eliminating the upper part—that is, it changes the quality of the tone but in no way changes the pitch. This is a rather startling result, namely, that a musical tone may be communicated to the ear having a pitch corresponding to C below middle C on the musical scale, and which is usually thought of as corresponding to a vibration rate of 128 cycles per second, and still such a musical tone may not have any frequencies below 600 or 700 cycles per second. A demonstration of this important experimental fact will now be made. An apparatus

is arranged so that vibration frequencies corresponding to 128, 256, 384, 512 up to 1024 can be produced either separately or in any combination. When they are all sounding together we have all the qualities of a musical tone—that is, a fundamental and a series of harmonics. It is arranged so that we can produce any combination of these frequencies, and we will let you listen to the results. [In this demonstration an electromechanical buzzer was adjusted to generate 128 cycles per second and all its harmonics up to 5000 cycles per second. This complex electrical wave was sent through eight resonant circuits in parallel, the first being tuned to 128 cycles, or to the frequency of the fundamental, and each of the successive remaining circuits being tuned to each succeeding harmonic. The electrical current coming from this set of tuned circuits actuated a loud speaking telephone. When either of the eight circuits was closed a pure tone was produced in the room. In this way the fundamental and its first seven harmonics could be produced with any relative intensities. With this apparatus it was demonstrated that when the tones corresponding to 1, 2, 3, 4, 5, 6, 7, 8 times the fundamental were sounded, a musical tone having a pitch of C below middle C resulted. If tones corresponding to 2, 4, 6, 8 only were sounded the pitch was an octave higher, or at middle C. When any two consecutive tones were sounded the fundamental of the series, namely, 128 cycles, was plainly audible. While tones 2, 4, 6, 8 were sounding, the tones 3, 5, 7 were added, which made the pitch become one octave lower—that is, in this case, by adding components of higher pitch the composite tone pitch becomes lower. When only the tones 5, 6, 7, 8 were sounding, the pitch still corresponded to 128 vibrations per second or to the fundamental of the series.

The high quality telephone system which was used in a previous demonstration was then used to show that this same result can be obtained from a musical tone produced in the ordinary way. A singer intoned the vowel "a" into the transmission system. Then by means of the filters the various frequency regions were eliminated. The singer was singing at a pitch corresponding to C below middle C, or corresponding to a fundamental vibration frequency of 128. By means of the filters all frequencies were eliminated below 750 without

altering the pitch, although the quality of the tone changed as the various frequencies were eliminated. It was noticeable that for the baritone voice which was used the elimination of harmonics, even above the 20th, had a very marked effect upon the quality of the tone.]

If this picture of the mechanism of hearing is correct, it is evident that the quality of the speech or music which is impressed upon the nerve endings will depend upon the intensity at which the sound reaches the ear. For, since quality depends upon the relative magnitude of the harmonics stimulating the nerve endings, and these in turn depend upon the intensity at which the sound is impressed on the ear, then the quality of any complex sound must change as its intensity changes. For this reason a musical selection which has been reproduced on the radio must be reproduced at the volume which the ear is accustomed to listening to it in order to produce the proper musical effects. A combination of musical sounds which would give the proper musical effect at one sound intensity may fail completely at other sound intensities. The next demonstration will show the effect of this ear distortion upon very loud speech. To convince yourselves that the distortion which you hear is actually being produced by the ear itself, just put your fingers to your ears until the sound reaching the inner ear has been reduced to a loudness corresponding to that ordinarily heard, and you will find that the speech will again sound natural. [In this demonstration the high quality telephone circuit was used to reproduce talking in an intimate conversational style. The amplification of the system was adjusted so that the people in the audience heard the sound at about the same intensity that they are used to hearing such a style of conversation. Under these conditions a very natural reproduction was produced. The amplification was then raised so that the intensity was many times greater than it was before. The reproduced speech then sounded very distorted. The low tones seemed to be very much too loud. The people in the audience verified the fact that the distortion was produced in the ear by the simple means of partially stopping up their ears with their fingers until the intensity of the sound was the same as at first. When this was done the naturalness of the speech was again established.

[In the next demonstration the high quality system was used to reproduce piano music. After listening to a short selection which was undistorted the filters were again introduced to eliminate various frequency regions. When frequencies below 500 cycles were eliminated the tone quality of the piano is practically destroyed. The elimination of frequencies above 2000 had only a slight effect upon the tonal quality. The elimination of these frequencies tended to make the sound smoother and more like that coming from a harp. However, it tended to spoil the brilliance, which may be very desirable for some types of music. As a final demonstration this same experiment was repeated, using a baritone solo in place of the piano for the reproduced sound.]

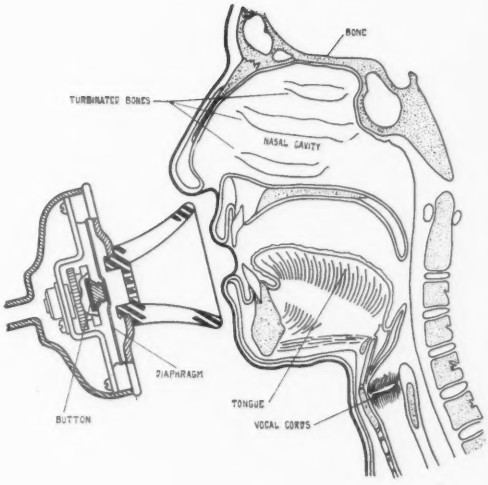

BONE
TURBINATED BONES
NASAL CAVITY
DIAPHRAGM
BUTTON
TONGUE
VOCAL CORDS

Figure 1.

Figure 2.

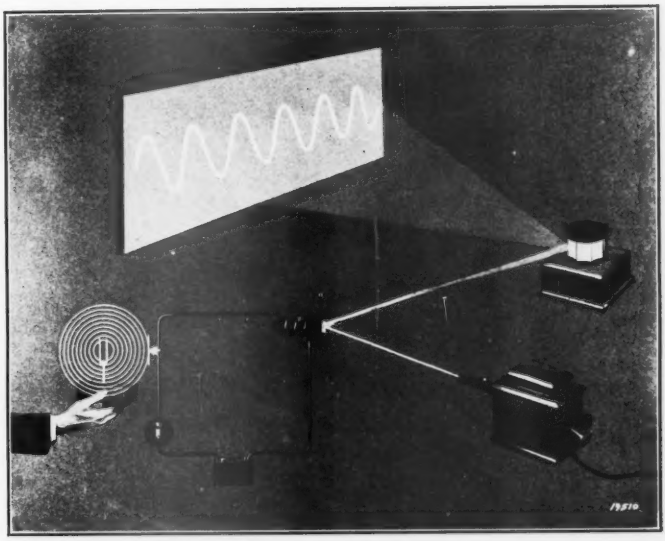


Figure 3.

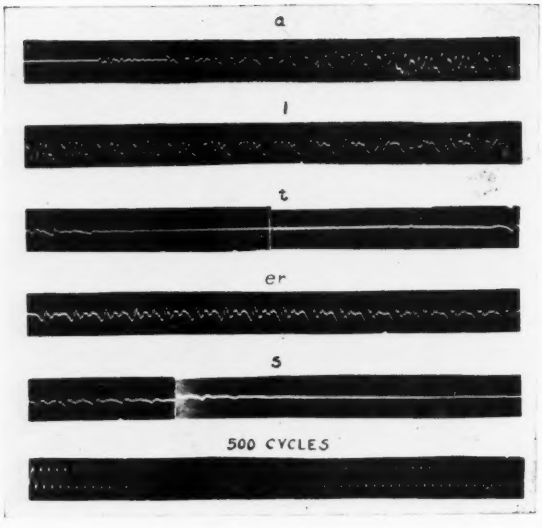


Figure 4.

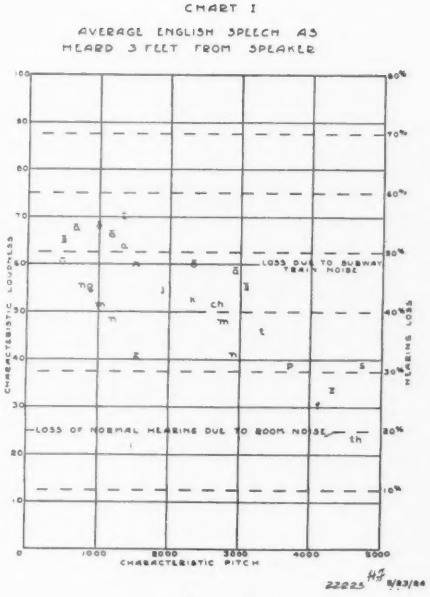


CHART I
AVERAGE ENGLISH SPEECH AS
HEARD 3 FEET FROM SPEAKER
CHARACTERISTIC LOUDNESS
HEARING LOSS
CHARACTERISTIC PITCH
LOSS DUE TO SUBWAY TRAIN NOISE
LOSS OF NORMAL HEARING DUE TO BOOM NOISE
100
80
60
40
20
0
1000
2000
3000
4000
5000
90%
70%
50%
30%
10%
ng
ch
th
22223 HF 9/23/44

Figure 5.

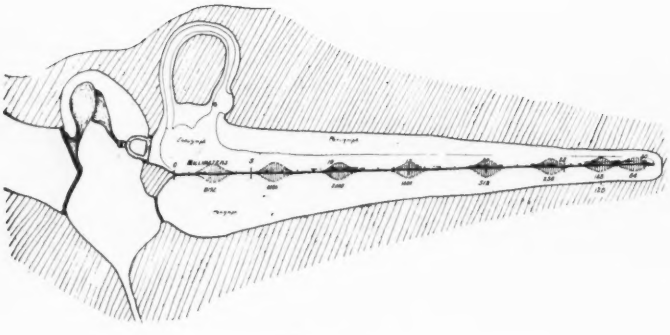


Figure 6.

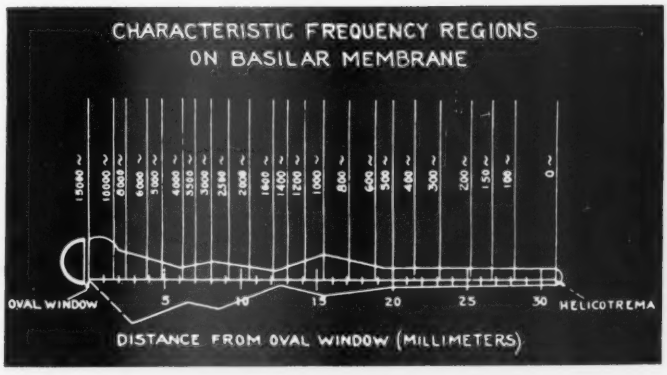

CHARACTERISTIC FREQUENCY REGIONS
ON BASILAR MEMBRANE
15040 ~
10000 ~
8368 ~
6000 ~
5000 ~
4000 ~
3328 ~
3000 ~
2348 ~
2000 ~
1600 ~
1400 ~
1200 ~
1000 ~
800 ~
600 ~
500 ~
400 ~
300 ~
200 ~
150 ~
100 ~
0 ~
OVAL WINDOW
5
10
15
20
25
30
HELICOTREMA
DISTANCE FROM OVAL WINDOW (MILLIMETERS)

Figure 7.

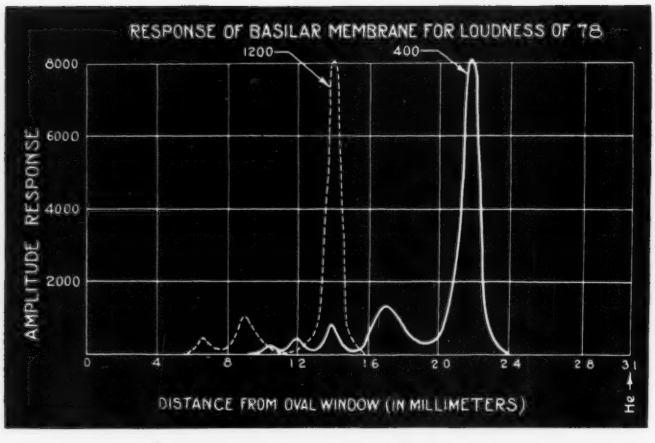

RESPONSE OF BASILAR MEMBRANE FOR LOUDNESS OF 78
1200
400
8000
6000
4000
2000
AMPLITUDE RESPONSE
0
4
8
12
16
20
24
28
31
He
DISTANCE FROM OVAL WINDOW (IN MILLIMETERS)

Figure 8.

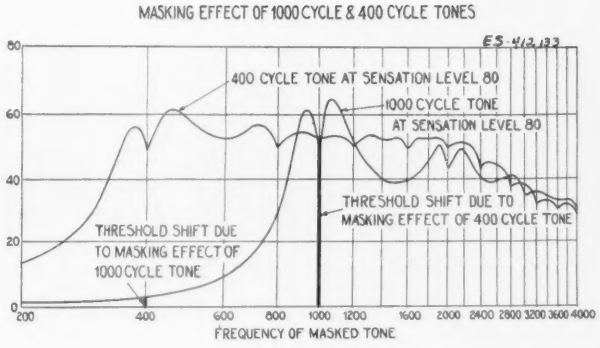

MASKING EFFECT OF 1000 CYCLE & 400 CYCLE TONES
ES-4/2,133
400 CYCLE TONE AT SENSATION LEVEL 80
1000 CYCLE TONE
AT SENSATION LEVEL 80
THRESHOLD SHIFT DUE TO
MASKING EFFECT OF 400 CYCLE TONE
THRESHOLD SHIFT DUE
TO MASKING EFFECT OF
1000 CYCLE TONE
80
60
40
20
0
200
400
600
800
1000
1200
1600
2000
2400
2800
3200
3600
4000
FREQUENCY OF MASKED TONE

Figure 9.

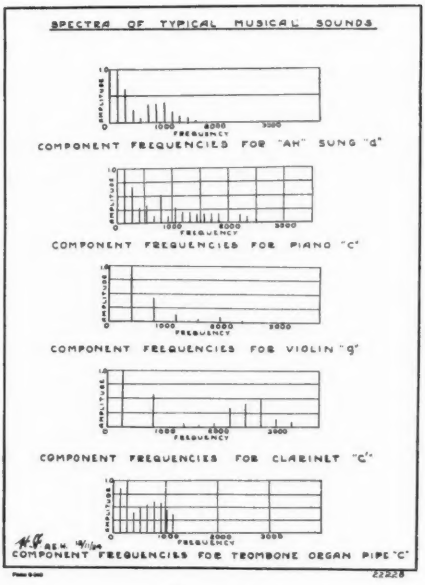

SPECTRA OF TYPICAL MUSICAL SOUNDS
AMPLITUDE
FREQUENCY
1000
2000
3000
COMPONENT FREQUENCIES FOR "AH" SUNG "G"
COMPONENT FREQUENCIES FOR PIANO "C"
COMPONENT FREQUENCIES FOR VIOLIN "g"
COMPONENT FREQUENCIES FOR CLARINET "C"
COMPONENT FREQUENCIES FOR TROMBONE ORGAN PIPE "C"
22228

Figure 10.

II.

THE PHYSICS OF SINUS DRAINAGE.

By Arthur W. Proetz, M. D.,

St. Louis.

Despite wide variations and disagreements in their ideas of what constitutes proper and effective treatment of suppurating sinuses, there is one desideratum upon which observers are united—that is, drainage. Obscure as may be the physiologic and biochemical reactions which affect this process, certain elementary laws of physics operate which certainly determine the effectiveness of the treatment and the course of the disease. It should repay us to examine these thoughtfully.

From a mechanical standpoint, each sinus is a rigid-walled polyhedral air cavity, communicating with the outer air through a relatively small opening. The passing of fluids from such a cavity involves, in fact, depends upon the elemental phenomena, viscosity of fluids; surface tension; pressure of gases, positive and negative; osmosis, and heat. The effects of these are modified by biologic activities, such as exudation and ciliary action.

The ostia, through which these rigid chambers must drain, occur in one of three positions: First, at the bottom, as in the frontal sinus (Fig. 1, a); second, at the side, as in the ethmoids and sphenoids (Fig. 1, b and d); and third, atop, or nearly so, as in the antrum (Fig. 1, c). These three types present three mechanical problems, so that they do not respond alike to physical agents, such as irrigation and suction, applied from without.

The ostia are normally patent and permit the free diffusion of fluids, but they may be wholly or partially occluded in various ways. Furthermore, some ostia which are swollen shut and do not permit natural ventilation may still yield to pressure from within or without.

AIR PRESSURE, POSITIVE AND NEGATIVE.

When the ostia are occluded, positive and negative pressures may be maintained in the sinuses for relatively short periods. These tend to become rapidly equalized, however, by the absorption of some of the enclosed air or the reaction of exudation.

The effects of air pressure in sinuses concern us chiefly in regard to certain forms of treatment. The simple application of suction to the nostrils, with the patient in the upright position, is a relatively ineffectual method, mechanically, of draining the sinuses.

To remove a fluid by suction or by postural drainage, from a rigid chamber through a small opening, two conditions are requisite: Its viscosity must be relatively low, and it must completely cover the opening (Fig. 2). If the viscosity or the surface tension be high, the exuded drop will not fall away from the ostium, but will be drawn back into the sinus when suction is released (Fig. 3). If the submersion of the ostium is not complete, there can be no effect produced by suction on the contained fluid; hence the uncertainty of simple suction as a diagnostic method (Figs. 5 and 6). Skillern says, "While this means [suction] seems to be based on sound theoretical grounds, practically it often leads to disappointment. Not only has this been the experience of the author but of others as well."[20] It appears to me that just here is the flaw in the theory.

Grant for the moment that the position of the ostium and the nature of the fluid are favorable for its removal by suction, still other physical restrictions interpose themselves. According to Boyle's law, the volume of a gas varies inversely as the pressure, the temperature remaining constant.

$$pv = km$$

where p is the pressure, v the corresponding volume of a given quantity of gas, m the mass of the gas, and k a constant factor of proportionality.

Assume that a given cell has an air capacity of one cubic centimeter, that it is half filled with a thin fluid and that its ostium is at the bottom in the optimum position. In order to

force out the ½ cm. of fluid, the volume of the ½ cm. of air will have to be doubled. In order to accomplish this the pressure outside the cell must be reduced by ½ atmosphere—a vacuum of 380 mm. of mercury, which is far beyond the limit of safety in the nose. What occurs in practice is, of course, that a very much smaller amount is removed at a time by a very much lower vacuum often repeated.

If the pressure in the nose be reduced by, say 1/6 of one atmosphere, the volume of enclosed air will be increased to 6/5 x ½ cm., or .6 cm., an increase of .1 cm. Therefore, .1 cm. of fluid will be forced out. Larger and smaller cells extrude amounts in exact proportion, not to their size, but to the volume of air they contain.

Therefore, if the contents of the cell are sufficiently fluid, and the head is in the proper position, repeated gentle suction will remove it a drop at a time. Under proper conditions the excursions of respiration (which Braune and Clasen[9] estimate produce in the maxillary sinus an average fluctuation of 12 mm. of water) are sufficient to withdraw fluids from the sinuses. I have frequently observed this in experimenting with solutions introduced into the sinuses by displacement. In many instances these solutions, which were flavored for ready identification, were pumped out by the respiratory excursions several hours after introduction, when the head was suddenly placed in a favorable position. Lipiodol, being more viscous, was much more difficult to remove, which introduces the factor of viscosity.

VISCOSITY.

This subject receives scant attention in most texts on physics and physical chemistry. In gases, liquids and plastic materials the term viscosity is applied to the friction between the component molecules of the substance as they pass over one another when changes in the shape of the mass occur. Exudates commonly encountered in the sinuses vary widely in their compositions and in their viscosities, and the latter are usually high, as compared with the viscosities of blood plasma and the transudates. The viscosity of exudates is almost invariably higher than that of the normal secretions. The sinus con-

tents are apt to be rich in mucin, the surface tension is high, and globules form readily.

We must not conceive of the pus in a sinus as being necessarily a thin fluid which readily seeks its lowest level. Instead, it often clings tenaciously to the walls, especially if these are irregular and divided by septa. Changes in the posture of the head many not cause it to shift its position in the sinus unless they are maintained for some time. When patients whose nasal fossæ are literally filled with pus lean forward, the pus does not escape from the nose as does, for instance, the thin fluid of hyperesthetic rhinitis. No more does the momentary shifting of the patient's head during the application of suction bring about a readjustment of the secretions within the sinuses sufficient for effective evacuation.

The writer has observed that much of the pus which is evacuated from the nasal fossa by simple suction has been dislodged from the vault of this chamber itself, the easily distensible membranes of the turbinates and the collapsible cartilaginous portions of the nose squeezing it out under the influence of the suction.

The viscosity of a substance is measured by the tangential force on a unit area of either of two horizontal planes at a unit distance apart required to move that plane with unit velocity in reference to the other plane, the space between being filled with the viscous substance.[8]

The ratio of the force required to move the one surface parallel to the other, to the velocity of such motion (or "shear") is known as the coefficient of viscosity. It is expressed by the symbol η.

$$\eta = \frac{\text{F (force)} \times \text{S (distance between faces)}}{\text{V (velocity)}}$$

It follows that in the case of fluids lying on inclined planes, such as secretions in sinuses, the value of v is low where the coefficient of viscosity is high, as the moving force F is limited to the weight of the drop itself.

In subacute inflammations, and still more in chronic ones, exudation is slow, and the coefficient of viscosity of the secre-

tion high. The movement of the mass under such conditions is that of a semisolid rather than a liquid.

The movement of a thick stream making its way through an ostium is not unlike that of emulsion globules passing through capillary tubes (Fig. 4). The center of the mass moves at the highest velocity, the periphery scarcely at all.

According to Yates,[24] the action of the cilia upon mucous masses is to roll them over and over, enveloping the débris in their path. The reader is referred to a review of this subject by Phillips,[16] in a recent number of this journal.

Such streams move slowly. Sometimes their surface tensions are so high and their components so elastic that they finally emerge from the sinus in a globular mass which retains its contour in the nose.

OSMOSIS.

Of the osmosis of colloids, as it affects sinus problems, only this need be said: That upon it depends the secretion within the sinuses, which determines the fluidity of their contents. And further, that as colloidal systems (which includes both the protoplasm of the living membrane and the products of inflammation which accumulate upon it) are especially sensitive to electrolytes in solution,[6] it should repay us to inquire more closely into the action of salts in various concentrations with a view particularly of improving the conditions of drainage. Digestive ferments are also to be considered for this purpose.

Temperature varies within relatively small limits in the sinuses, and its effects from a purely physical standpoint are negligible.

It appears that the fluidity of the cell contents is perhaps the most important single factor in drainage, assuming that the ostium is open or can be opened. It was with this in mind that the writer lately devised a method of irrigation by displacement of the air in the sinus cavities and the introduction of fluids in order to thin the secretions, thus allowing them to flow out, rather than attempting to draw them out when they are too viscous to flow.

This is accomplished by the simple expedient of placing the sinus with its ostium up, filling the nasal chamber with the irrigating fluid and gently exhausting the air by applying suction to the nostril. On releasing the suction some of the overlying fluid is drawn into the sinus.[17] It remains there for many hours, diluting the secretions, mitigating their irritating action and loosening them from the sinus walls. But above all, it renders them sufficiently fluid to be easily discharged by physiologic processes or to be withdrawn by reapplication of suction with the sinus inverted.

This paper makes no pretense at originality of thought or investigation. It is only an attempt to line up for inspection a few elemental physical phenomena which cannot be ignored if we are to devise simpler and more effective means of emptying sinuses.

REFERENCES.

1. Adam: Viskosität des Plasma. Berlin. klin. Wochenschr., 1909.
2. Ames, J. A.: General Physics, 1904.
3. Arago, Babinet, Poibert and Regnault, Cf. by Poiseuille: Experimental Research on the Movements of Liquids Through a Tube of Very Small Diameter. Annals of Chem., 50.
4. Bancelin, M.: The Viscosity of Emulsions. Compt. rend., 1911, page 1382.
5. Bary, P.: The Viscosity of Colloidal Solutions. Compt. rend., 1920, page 1388.
6. Bayliss, Wm.: Principles of Physiology, 4th ed., 1924.
7. Beck, C., and Hirsch, C.: Die Viskosität des Blutes. Arch. f. Exp. Path. u. Phar., 54, 1905.
8. Bingham, E.: Fluidity and Plasticity, 1922.
9. Braune and Clasen: Die Nebenhöhlen der menschlicher Nase, etc. Zeit. f. Anatomie, 1877, Vol. 2, page 1.
10. Burri, R., and Nussbaumer, T.: Surface Tension and Viscosity Determinations of Milk and Other Fluids. Biochem., A., 90.
11. Chick, H., and Lubrzynska: Viscosity of Some Protein Solutions. Biochem. J., 859, 1913.
12. Hatschek, E.: The Viscosity of Dispersed Systems. Z. Chem. in Kolloide, 1910, page 301.
13. Loeb, Jacques: Colloidal Behavior of Proteins, etc. J. Gen. Physiol., 4, 463-621; 5, 109.
14. Mayer, A.: Rôle de viscosité dans les phenomines osmotiques et dans les echanges organiques. Compt. rend. Soc. Biol., 1901, page 1138.
15. Moore, B., and Parker, W. H.: The Osmotic Properties of Colloidal Solutions. Am. J. Physiol., 7, 261, 293.
16. Phillips, F. L.: Rôle of Ciliated Epithelium in Sinusitis. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, Vol. XXXV., No. 3, Sept., 1916, p. 709.
17. Proetz, A. W.: Displacement Irrigation of Nasal Sinuses. Archives of Otolaryngology, July, 1926, p. 1.

18. Proudman, J.: Notes on the Motion of the Viscous Liquids in Channels. Phil. Mag. (6), 30, 1914.
19. Snyder, C. D., and Todd, M. H.: The Viscosity of Body Fluids at Various Temperatures Within Physiological Limits. Am. Journal of Physiol., 161, 1911.
20. Skillern, R. H.: Accessory Sinuses of Nose, 4th Ed., 1923, p. 85.
21. Sörensen, S. P. L.: Studies on Proteins. C. R. Lab., Carlsberg, Copenhagen, 1917.
22. Tilley: Transactions of International Laryngological and Rhinological Congress, Vienna, 1908, p. 221.
23. Uffenorde: Kritische Bemerkungen über die Sondermannsche Saugmethode, etc. Muench. med. Wochenschrift, June 12, 1906.
24. Yates, A. L.: Methods of Estimating the Activity of the Ciliated Epithelium Within the Sinuses. Jour. Laryngology and Otology, Vol. XXXIX, No. 10, Oct., 1924.

234 University Club Building.

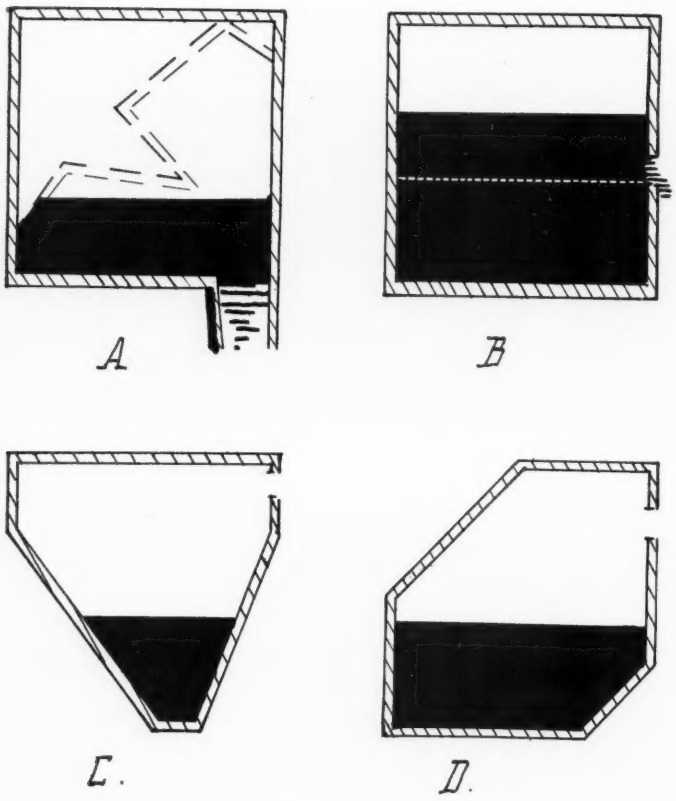


Figure 1.

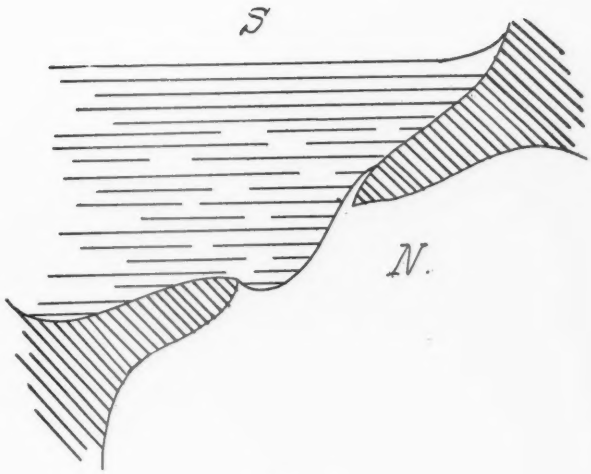


Figure 2.

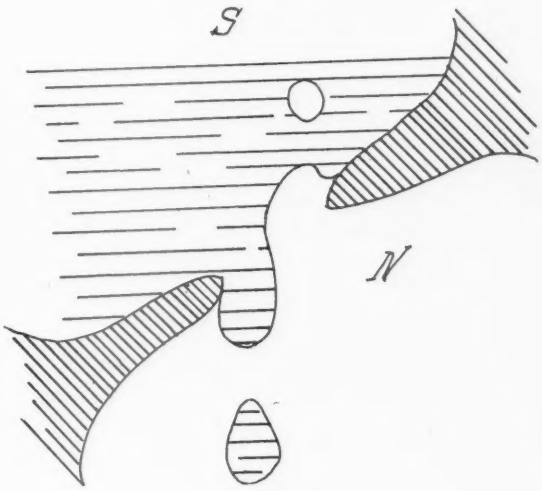


Figure 3.

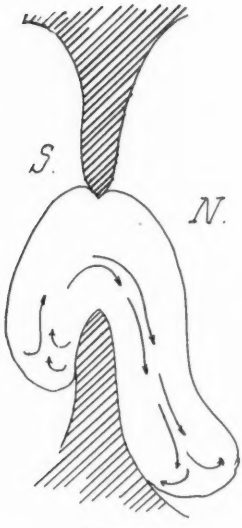


Figure 4.

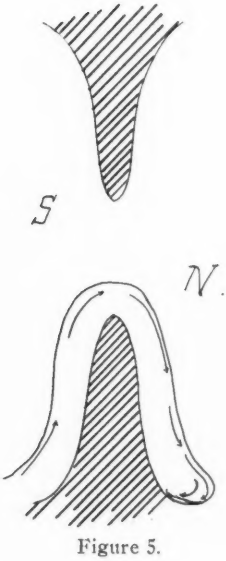


Figure 5.

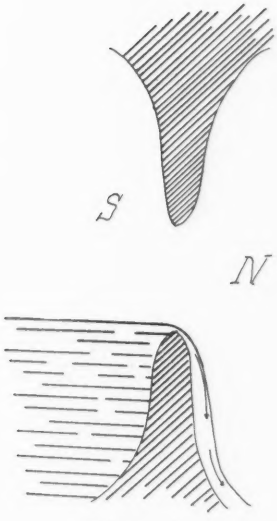


Figure 6.

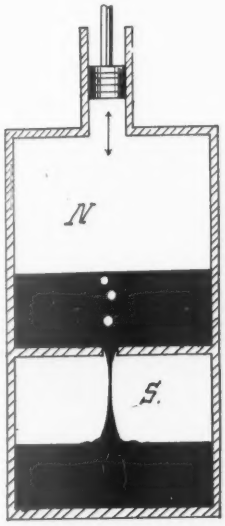


Figure 7.

III.

DIAGNOSIS OF NASAL SINUS DISEASE.

By Edward King, M. D.,

Cincinnati.

It seems best to me to confine my remarks in this short paper to a few observations on the maxillary antrum. There is a rather well founded belief among the laity that one nasal operation begets a second, and from there on ad infinitum. No doubt this is owing to the tendency of nasal polypi to recur. Very often, in recommending a nasal operation to one of our patients, we hear the story of a relative who has had innumerable operations on the nose without very much relief. We endeavor to explain the nature of the disease and to excuse our lack of measures for eradicating it, but, unfortunately, we are not in a position to assure the patients who come to us for relief from nasal polyposis that the disease will not reappear. In spite of the most painstaking work, we do find recurrences; hence it is necessary to give each case the most thorough study in order to diminish the number of failures as far as lies in our power.

Repeated attacks of inflammation in the nose and the extension into the sinuses give rise to chronic inflammatory changes in the sinus mucosa, resulting in thickening of the mucous membrane and pressure on the deeper layers containing the glands. The mucous membrane becomes edematous and the glands become cystic. The antrum is particularly susceptible to these changes because of its position. No doubt a large middle turbinate which hugs the lateral wall is an important factor in the causation, because it prevents aeration and drainage. In acute suppurating sinus infections the antrum is the last to drain. On numerous occasions it has been my experience to find large quantities of pus in the antra following an acute cold after all symptoms had disappeared and the nose showed no signs of pus. To my mind, it is not difficult to conceive of chronic changes in the antrum without very marked signs in the nose.

As a rule, the hyperplastic changes which give rise to symptoms occur in adults. However, we have had some experience with polypoid changes in children, and no doubt as our knowledge of sinus disease in childhood increases we will have more occasion to see these conditions.

The details of three cases which I have had the opportunity to study may be of interest in this connection. The first is that of a child, age 8, who gave a history of chronic suppurating sinus disease following an attack of measles at age 3. The operation revealed polypoid changes in the ethmoids and antra. The ethmoids were removed and a very large opening made under the inferior turbinate in both antra. The most careful after treatment was given, with a great improvement in the child's health, but I am afraid that the antra will not respond without more radical surgery.

The second case is that of a boy, age 10, who gave a history of vasomotor rhinitis since the age of 5. The tonsils and adenoids and a small piece of the middle turbinate on both sides had been removed at a previous operation. Examination revealed polypoid degeneration of the middle turbinate and the ethmoid cells. Radiograph of the sinuses revealed cloudy ethmoids and antra. The middle turbinates and ethmoids were removed and an opening made into the antra through the inferior meatus. Complete relief from all symptoms was the result for about eighteen months, when the condition recurred gradually. Examination revealed the polypi in the nose and the openings into the antra completely closed. The X-rays again showed cloudy antra, and opening through the canine fossa was recommended. The family refused to submit the child to any more surgery, at least at my hands.

The third case is that of a boy age 14. His only symptom was difficulty in breathing. The history revealed that he had been operated on for nasal polyps on two previous occasions. At the age of 9 a large mass of polyps had been removed from the left side of his nose. He was operated upon again at 12 years of age for the same thing. Examination of this boy showed a large polyp completely occluding the anterior nares. Postrhinoscopy revealed a number of polyps retronasally. The X-rays showed marked clouding of the left antrum. At oper-

ation the antrum was opened in the canine fossa, and a large mass of polypoid material was found filling the cavity. Some of this mass extended into the nose. This boy has been free from polyps for a period of over two years. An analysis of these cases points to the fact that marked hyperplastic changes are found early in childhood and that the antrum may be involved.

The diagnosis of well marked cases of hyperplasia does not offer many difficulties, but in a study of these cases and in recommending an outline of treatment it is necessary to consider the antrum. The removal of polyps is rather simple and the relief is so prompt that we may approach the operation without careful consideration of all the factors. After thoroughly removing every vestige of polyps and exenterating all cells and opening the sphenoid, it is rather discouraging to have the patient return in a short time with the nose full of polyps again. I believe that when the X-ray shows clouding of the antra in the presence of nasal polyps, the antra should be opened through the canine fossa.

The less marked and mild degrees of hyperplasia demand constant and continued study. There may be very slight changes noted on inspection of the nasal cavity. The middle turbinate may be normal. The ethmoid must be inspected carefully. To make the examination it is necessary to infract the middle turbinate and examine the ethmoid floor and lateral nasal wall while holding the turbinate over toward the septum. The nasopharyngoscope may show mild hyperplastic changes around the antrum opening. In vasomotor rhinitis it has been my experience that the signs may be present at one examination and absent at another, so that repeated examinations may be necessary. A grayish exudate under the middle turbinate, which gives me the impression of a damp ethmoid, may be seen at times.

The diagnostic irrigation should be made in all cases. This procedure should be carried out through the middle meatus. Too much stress cannot be laid on this method of washing the antrum, because of the ease with which it is performed. The cannula, which is to be presented for your approval, is designed to enter the middle meatus under the middle turbinate so that there is never any necessity for disturbing this struct-

ure. It is firm enough to pass through the thin membranous partition with ease if the natural or the accessory opening cannot be located. The bore of the cannula is large enough to permit a stream of water as great as the ordinary diagnostic needle. In practice the upper surface of the inferior turbinate and the lateral wall of the middle meatus are cocainized with 20 per cent cocain on a fine bent cotton carrier. The cannula is then employed as a probe to feel for the opening and inserted in the most favorable spot. If there is any doubt as to its location, a bent probe may be used to verify the position of the opening. This method has none of the disadvantages of antrum puncture and should be used more generally.

X-rays of the sinuses must be made in all cases. The interpretation of the pictures rests on the clinical findings. With the presence of polyps in the nose and cloudy antra on X-ray, the antra should be opened. Lipiodol has been of value in these cases because it outlines the polypoid mass. Two slides showing the lipiodol surrounding and outlining the tumor mass are to be shown.

Where the X-ray shows slight clouding or the picture is negative, we must depend on the clinical findings and experience for the course to pursue.

In doubtful cases it is advisable to make a window in the facial wall of the antrum in order to make a direct inspection of the mucosa. A nasopharyngoscope or a small mirror can be inserted through this opening for a survey of the entire cavity. Experience with this procedure has taught me that very often, when we would be inclined to give the antrum a clean bill or to make an intranasal opening and hope for a good result, the small window has disclosed pathologic changes which warrant only a radical antrum. It is simple to make the opening, and, if the antrum is clear, then the mucous membrane can be closed without any injury to the patient.

707 RACE STREET.

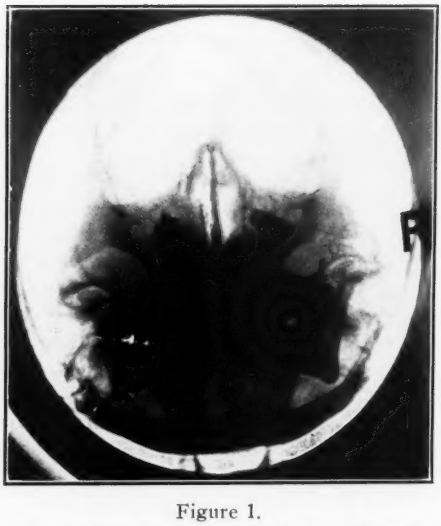


Figure 1.

The above illustration shows the dipping in effect of the lipiodol in a case of marked hyperplastic maxillary sinusitis.

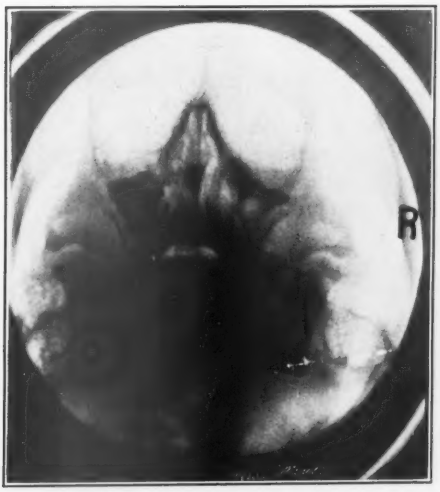


Figure 2.

The above illustration shows the lipiodol filling the antra and surrounding the tumor mass which is indicated by the lighter circular areas.

IV.

CICATRICIAL (BENIGN) STRICTURE OF THE ESOPHAGUS: TABULATED REPORT OF ONE HUNDRED EIGHTY-SIX CASES.*

By Porter P. Vinson, M. D.,

Section on Medicine, Mayo Clinic,

Rochester, Minn.

The healing of esophageal or peri-esophageal inflammation with the formation of scar tissue frequently produces a narrowing of the lumen of the esophagus, which results in partial or complete obstruction to the passage of food.

ETIOLOGY.

The most common cause of benign esophageal stricture is the ingestion of household lye, either in solution or granular form. Peri-esophageal abscess may result from a severe burn and the patient die from mediastinitis or shock before stricture forms. Even if a small amount of greatly diluted solution is ingested, the esophagus is usually burned sufficiently to produce a stricture. When granular lye is ingested the mouth sustains the major part of the burn and the esophagus frequently escapes injury.

The swallowing of lye is almost always accidental, and the burn produced is less severe than when it is swallowed with suicidal intent, in which case the burn may extend into the stomach. In one instance it caused ulceration at the outlet of the organ, which resulted in marked contraction and almost complete pyloric obstruction.

Esophageal and peri-esophageal inflammatory processes are probably quite common, although they may not produce symptoms unless they are severe enough to reduce the esophageal

*Read before the American Bronchoscopic Society, May 29, 1926, Montreal, Canada.

lumen when healing occurs. In eighteen of our cases there was no tangible cause for the stricture.

Ulceration in the esophagus during the course of typhoid fever had been the etiologic factor in fourteen cases. Thirteen had resulted from vomiting during pregnancy. Various caustics, congenital defects and infectious diseases were responsible for the remaining cases (Table 1).

AGE INCIDENCE.

In considering benign stricture of the esophagus one is likely to think of it as occurring in childhood only. However, sixty-six of our patients developed stricture after the age of fifteen and thirty-two after the age of thirty-five (Table 1). The duration of the stricture varied from a few days to fifty years.

SITUATION (TABLE 1).

It is difficult to account for the site of benign strictures of the esophagus in all cases. Those resulting from typhoid and the vomiting of pregnancy, as well as those of questionable etiology, are usually situated in the lower third of the esophagus. Such strictures may vary in extent and density, but all of them are single. Strictures resulting from the swallowing of a caustic may be found in any portion of the esophagus, but are most commonly observed in the upper third. They may be single but are often multiple, and in some cases the entire esophagus is scarred, with several points of increased density. When patients have developed a stricture early in life and have lived in comparative comfort for many years without treatment, it can logically be assumed that the stricture is short, with a fairly wide lumen. In certain cases there is nothing more than a thin fibrous band across the esophagus, which produces a moderate degree of dysphagia.

DIAGNOSIS.

In the majority of instances the diagnosis of cicatricial stricture of the esophagus, as well as its etiology, can be determined from the history alone. In only 10 per cent of the cases in this series was the cause undetermined.

TABLE 1.

CAUSE, AGE INCIDENCE AND SITUATION OF STRICTURE OF THE ESOPHAGUS.

CAUSE	Cases
Lye	102
Unknown	18
Typhoid	14
Vomiting of pregnancy	13
Congenital	7
Hydrochloric acid	5
Scarlet fever	3
Ammonia	3
Mediastinitis	2
Tuberculosis	2
Caustic type ?	2
Diphtheria	2
Bichlorid of mercury	2
Carbolic acid	1
Syphilis ?	1
Thrush	1
Pneumonia	1
Sulphuric acid	1
Cardiospasm with plastic operation on cardia	1
Acid type ?	1
Silver nitrate	1
Nitric acid	1
Foreign body	1
Cut by razor	1

AGE INCIDENCE	
Youngest patient, 17 months, oldest patient, 75 years.	
	Cases
Fifteen years and younger	87
Sixteen years and older	99
Stricture acquired after 15 years of age	66
Stricture acquired after 35 years of age	32
SITUATION	Cases
Upper third	75
Middle third	46
Lower third	43
Not stated	22
	186

Under ordinary conditions rentgenoscopy and esophagoscopy are not necessary to arrive at a diagnosis. Rentgenoscopy reveals an obstruction only and does not indicate its character (Figs. 1 and 2). One may even be misled by the rentgen-ray picture when food particles are retained in the esophagus above the stricture and produce an irregularity like that of carcinoma.

In doubtful cases esophagoscopy should always be made, but it must be borne in mind that the gross appearance of a

benign stricture surrounded by granulation tissue closely resembles that of carcinoma, and even though the tissue removed for examination is reported by the pathologist to be inflammatory only, one can never be sure that there is no underlying malignant condition. It is not unusual to see cases of carcinoma in which it is impossible to remove a piece of tissue that will show malignant change. Therefore, a stricture presumably benign may be malignant. Time alone can make the diagnosis absolute. Malignant degeneration may occur in the scar of a benign stricture. One of the patients in this group developed carcinoma, and two patients with carcinoma had had a benign stricture for many years previously. The stricture in all the cases had followed the ingestion of lye.

TREATMENT.

In treating benign esophageal stricture, it is desirable to increase the lumen of the cicatrized esophagus as quickly as possible with the least risk and discomfort to the patient, and to produce a permanent functional result. It is impossible to present inflexible methods of management. Olive oil should be given immediately after the burn as an antidote and first-aid treatment. There is usually a severe local and general reaction and the patient is unable to swallow even liquids. During this period of complete closure, which usually lasts for three or four days, fluid should be given by rectum and, if necessary, subcutaneously. As soon as the acute reaction subsides the patient can take fluids, and at this time he should swallow a twisted silk thread to be used later for guiding sounds through the stricture. Not more than a foot of size D buttonhole twisted silk should be ingested every hour, and after three or four yards have been swallowed a larger size (EE) should be tied on and three or four yards of this allowed to pass into the stomach. Finally, an ordinary bass line is attached to the previously swallowed thread; this may be brought through the nose to prevent the patient from chewing it.

Peristalsis gradually pulls the thread into the intestine and a segment must be cut off at each movement of the bowels. It must be emphasized that twisted silk, not braided silk, is

used in the beginning. The primary use of braided silk invariably results in failure. After a sufficient quantity of twisted silk has been swallowed, the peristaltic action of the intestinal tract will pull any type of thread into the stomach and then the braided fishline can be employed. The use of the thread has made gastrostomy unnecessary in all save twelve cases. Twenty-one patients had had the operation before coming to the Clinic. When one considers that gastrostomy entails a mortality risk of from 10 to 25 per cent, as well as additional discomfort and a period in the hospital for such patients, the value of the thread is apparent. After the patient has swallowed the thread he is permitted to take as much liquid and semisolid food as he desires.

Secondary closure from contraction of scar tissue usually reduces the lumen of the esophagus in six weeks to a size that will not permit the free passage of liquids, and at this time it is necessary to begin dilatations. Using the thread as a guide, a sound, usually 30 F, is passed through the stricture and immediately withdrawn (Fig. 3). This usually causes slight bleeding but ordinarily no general reaction.

The patient is able to take soft foods with ease for a week or ten days, then a sound two sizes larger than the first is passed into the stomach. After this, it is rarely necessary to keep the thread in place, and the patient swallows a new one before each subsequent treatment. The size of the sounds is increased at each stretching, only one being passed through the stricture at each treatment, and the time between dilatations is lengthened as rapidly as possible.

After the third or fourth instrumentation, it is possible to wait two to three weeks between treatments, and the patient may return home until another treatment is necessary.

By the end of three or four months the lumen of the stricture is usually dilated to 45 F, and further treatment may often be carried out at home under the direction of the patient's physician. If medical attention is inaccessible at home, a relative is instructed to carry out the dilatations, and the thread technic makes the instrumentation simple and safe.

The majority of patients are first seen when esophageal closure is almost complete and dehydration is marked. If

dehydration has been gradual, it is better tolerated than if closure has been sudden. If it is pronounced the administration of water by proctoclysis and hypodermoclysis affords much comfort and allows time for the thread to be swallowed. If no progress is made in ingesting the thread, there are two alternatives: gastrostomy or esophagoscopy, with the introduction of a ball tipped paino wire through the stricture, followed by the dilating sound (Fig. 4). As both of these alternatives increase the risk in treatment, it is advisable to persist in efforts to have the patient swallow the thread. If the patient is a child it may be necessary to employ a special nurse to assist. Some children can be handled more easily if they are strapped to a Bradford frame. The passage of the thread may be facilitated by introducing it through the nose.

Esophagoscopy with the use of the piano wire for a guide at the initial dilatation was employed in thirty-one cases with three fatal results. Gastrostomy in twelve cases was followed by three deaths. The other nine patients were able to swallow a thread after the operation, and the normal lumen of the esophagus was restored by dilatation. In twenty-one cases gastrostomy had been performed before the patients came to the Clinic, and in seven of these there was complete esophageal stenosis. In fourteen the patient was able to swallow a thread and the stricture was easily dilated. After gastrostomy the patient swallows the thread in the usual manner, and if obstruction is not complete it will pass into the stomach. If a few niches are made on the gastrostomy tube the thread will become entangled in them and can easily be withdrawn from the stomach (Fig. 5).

The heavy fishline is then attached to the lighter silk thread and the dilating sounds are pulled through the stricture. The gastrostomy tube is removed after one or two dilatations and the fistula usually closes spontaneously. In three cases secondary operation for closure was necessary.[1] We have not used the heated bougies employed by Dean, although they may be of definite value in certain resistant types of scar tissue. The rubber bougies described by Tucker for retrograde dilatation require gastrostomy, and unless the operation is necessary because of marked obstruction, we do not advocate their use. Passing unguided bougies through an esophagoscope in case

of multiple strictures is nothing more than blind instrumentation, and this method of treatment should be avoided (Fig. 3d).

We have not attempted to restore the lumen of an impermeable stricture by the ingenious method described by King.

Nine of our patients had thirteen foreign bodies impacted in their strictures during the course of treatment. Esophagoscopy was, of course, necessary for their removal.

PROGNOSIS.

Although patients suffering from benign stricture of the esophagus usually require prolonged treatment, the ultimate functional result is very satisfactory. It is impossible to predict the duration of treatment necessary in any case. Not infrequently a short stricture of moderate density will need treatment for a longer period than an extensive cicatrix. Treatment should be carried out for from two to three years, after which the patient is advised to have a sound passed once a year for three or four years, even if he is entirely free from dysphagia. It is important for the stricture to be dilated as much as 45 F. If treatment is suspended when the lumen has been enlarged to from 30 to 35 F, the patient almost always has dysphagia later in life and must take great pains to prevent impaction of ordinary foods.

Under no conditions should a stricture be permitted to close completely. One of the pitfalls of gastrostomy is that after the operation food can be introduced into the stomach and the patient is permitted to go without treatment for months or years until the stricture becomes impermeable. Complete closure can always be prevented by the introduction of a thread, provided it is done soon enough. In our series eight patients came with complete esophageal obstruction, in one case the result of a congenital deformity. Five patients declined to remain for treatment.

MORTALITY.

Five deaths followed dilatation, and in every case the rupture occurred at the first stretching. Preexisting peri-esophageal abscess, partial involvement of the esophagus with scar tissue from an infected mediastinal gland, probable hemorrhage from the esophagus, and the splitting of scar tissue in two cases

were responsible for these five deaths. Three deaths followed an attempt to establish an opening through the esophagoscope in cases of complete obstruction. Three patients died following gastrostomy. There were ten deaths not associated with instrumentation in the Clinic (Table 2).

CONCLUSION.

As most benign strictures result from the careless use of lye and a lack of appreciation of the fact that it is a deadly poison, the medical profession should render every possible support to the Committee on Lye Legislation in their efforts to warn the public of the dangers attending its use.

TABLE 2.

MORTALITY.	CASES
Deaths following dilatation	5
Deaths following attempts to establish opening in impermeable stricture	3
Deaths following gastrostomy	3
Deaths from other causes	10
Perforation resulting from dilatation (elsewhere)	2
Malignant degeneration	1
Intravenous injection of glucose	1
Perforation from foreign body	1
Starvation	1
Pyloric obstruction	1
Pellagra	1
Acute rheumatic fever	1
Tetany	1

BIBLIOGRAPHY.

1. Dean, L. W.: Result of the Use of the Heat Hyperemia in the Esophageal Stricture. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, 1921, XXX, 1055-1056.

2. King, Edward: A New Method of Restoring the Lumen in a Case of Impermeable Stricture of the Esophagus. Surg., Gynec. and Obst., 1924, XXXIX, 596-598.

3. Tucker, Gabriel: Cicatricial Stenosis of the Esophagus, with Particular Reference to Treatment by Continuous String, Retrograde Bouginage with the Author's Bougie. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, 1924, XXXIII, 1180-1214.

4. Vinson, P. P.: Stricture of the Esophagus Occurring During Pregnancy. Am. Jour. Obst. and Gynec., 1923, VI, 346-348.

5. Vinson, P. P.: Stricture of the Esophagus Following Typhoid Fever. Med. Clin. N. Amer., 1923, VII, 57-61.
6. Vinson, P. P., and Hartman, H. R.: Pyloric Obstruction Due to Swallowing a Solution of Concentrated Lye. Med. Clin. N. Amer., 1925, VIII, 1037-1040.
7. Vinson, P. P., and Moersch, H. J.: Severe Burn of Mouth from the Accidental Ingestion of Granulated Lye. Laryngoscope, 1925, XXXV, 127-128.

Fig. 1. Diagnosis of carcinoma of esophagus by roentgen-ray examination.

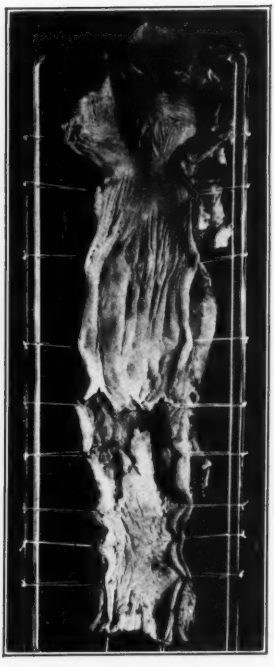


Fig. 2. Specimen from esophagus shown in Fig. 1. Stricture is benign. Patient succumbed to myocardial degeneration and tetany.

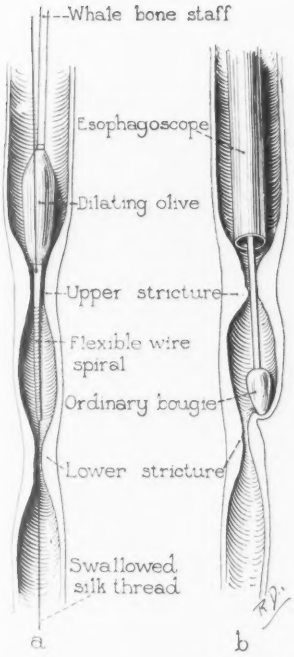


Fig. 3. a. Method of introducing the dilating olive on swallowed silk thread. b. Dangers attending the use of unguided dilator when introduced through an esophagoscope in cases of multiple esophageal stricture.

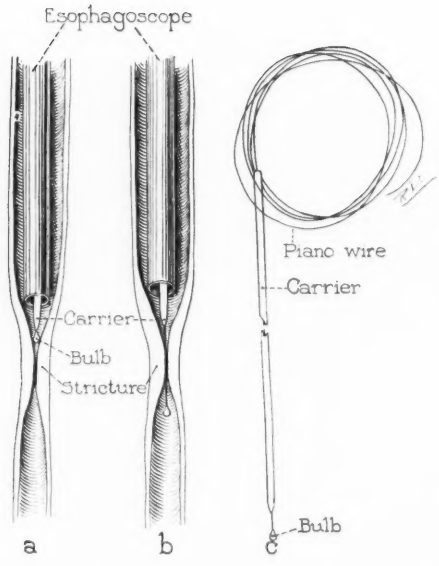


Fig. 4a. Carrier and wire introduced through an esophagoscope to esophageal stricture. b. Wire threaded through carrier introducing bulb beyond esophageal stricture. c. Piano wire with bulb introduced through carrier.

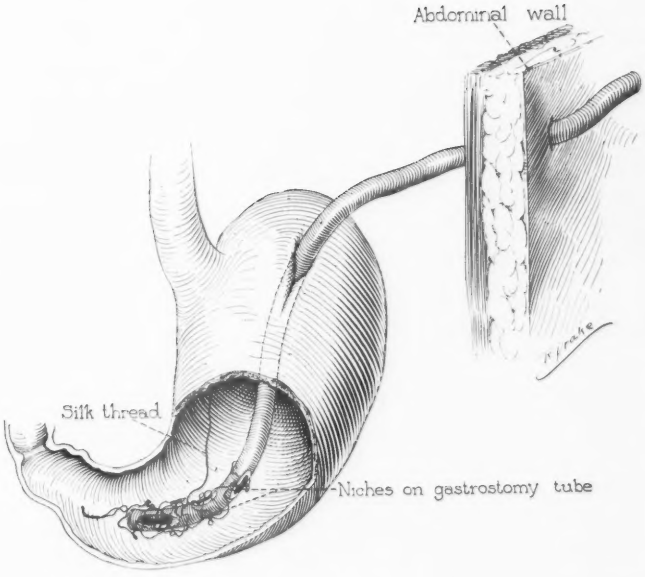


Fig. 5. Method of entangling swallowed silk thread on gastrostomy tube.

DISCUSSION.

DR. RICHMOND MCKINNEY, Memphis, Tenn.: Cases of simple inflammatory stenosis of the esophagus have been reported by Jackson, Guisez and myself, all of these occurring in adults. A candidate's thesis for the American Laryngological, Rhinological and Otological Society, presented by me several years ago, took this condition for its subject. I am interested in lye strictures. I have had fifty cases in ten years. These cases were mostly in young children. Only three were in adults. There are many cases in the South among the "poor white trash." The children are apt to get hold of the cans, left around carelessly by the mothers, and think the lye in solution is milk, or in crystals, is sugar. The delay in the development of the strictures is interesting. One woman of 21 came to me who had taken the lye a year before. She had developed stricture and was dying of water hunger. One matter Dr. Vinson and I disagree upon: he says these cases can be cured. I do not think a complete cure is possible. You cannot clear up the scar tissue, and there will always be some contraction of the esophagus, although deglutition may be good. I have been treating one child eight years, and she is pretty healthy, but under the fluoroscope there is the remnant of the stricture. These patients keep on coming and getting dilatation. I may say in passing they are always charity patients. I have never had one of them pay me anything. These lesions are very hard to deal with. If you can get them to swallow a string it is better, but do not let the child get away, because if you do the stricture will close, and it is very difficult to overcome. I was not surprised to hear that three deaths were reported from cutting through the stricture. I know of one case in which the physician attempted to work with a cutting instrument through the esophagoscope, to cut the stricture. The patient died the next night. There was a very thin wall to the esophagus. The patient was willing to die rather than go on living in that condition. I know of two cases who want to take the risk. I fear I shall kill them both if I undertake to cut through the strictures.

DR. S. IGLAUER, Cincinnati: Dr. Vinson has given us a very fine review of this subject. I do not recall if he mentioned

stenosis following ulceration due to scarlet fever. Some years ago I reported such a case before this society. I have recently found a new cause for esophageal stricture and that is "prohibition." I have had two cases that have taken lye by mistaking it for whisky or while under the influence of whisky. One man developed three strictures in a row. He was drunk and probably did not eject the lye quickly enough. In this case the strictures were smaller the further removed from the mouth. By the aid of a swallowed string both cases were successfully dilated. We had another case of a man who swallowed acid and developed an esophageal stricture. When he came to us he was extremely dehydrated and emaciated. He was too ill for esophagoscopy and was referred to the surgical service for a gastrostomy. After gastrostomy the food ran out immediately. This led to a diagnosis of pyloric obstruction, which was found on second operation when a gastroenterostomy was performed. The pyloric obstruction was undoubtedly due to the acid which had been swallowed. The patient is now making a slow recovery.

Dr. L. H. Clerf, Philadelphia: In the cases of atresia of the esophagus, I believe that the safest and best method of treatment is that devised by Dr. Chevalier Jackson, which consists of combined peroral and retrograde esophagoscopy, performed with the assistance of a double planed fluoroscopy, as advocated by W. F. Manges. With the esophagoscopes carried from above and from below to the cicatricial barrier, the roentgenologist, with the aid of the double planed fluoroscope, lines them up so that their distal extremities are on the same plane in every diameter and their long axes parallel. With a radiopaque flexible tipped bougie carried through one esophagoscope as far is it will go, a specially devised forceps is introduced through the other esophagoscope and the cicatricial barrier penetrated. The tip of the bougie is then grasped with the forceps and drawn through the newly made lumen, and with this a string is carried through for subsequent retrograde bouginage. I believe that this procedure constitutes the safest known method of treatment in these cases.

Dr. Waugh: I would like to ask about the mortality statistics in relation to gastrostomy. I think 10 to 25 per cent is too high. I think he meant if the esophageal stricture became

closed. Gastrostomy has not a mortality of 10 per cent, in my opinion. I think in using the esophagoscope one should make a larger opening than usual. The adhesions may loosen or a fatality result from peritonitis.

DR. CUNNINGHAM, Vancouver: I would like to ask Dr. Vinson one question: To what size do you dilate lye strictures at various ages? I think we should have figures in comparing results. These cases are never cured, in one sense—that is, they will always have scar tissue; perhaps we should say relieved, but when they can eat everything without need of further stretching they are comparatively cured. I have one patient who has been eating everything for six years without treatment. She regards herself as cured.

DR. MCKINNIE, Washington: The diagnosis of multiple strictures by the rentgen-ray depends upon the degree of obstruction produced by the first stricture. If the lumen is large enough to permit barium to pass freely it is, of course, possible to determine the fact that there are other strictures in the lower esophagus. We have had three strictures of the esophagus from scarlet fever. Our youngest patient suffering from benign esophageal stricture was seventeen months of age, and this child was dilated to a 45 French. All of our deaths from instrumentation have occurred at the first treatment. The mortality following gastrostomy was difficult to ascertain, because there are no large series of cases reported. I am afraid the maximal mortality was in our own cases.

DR. VINSON (closing): In regard to the size of the sound, the youngest child we had was 17 months, and we dilated with sounds up to No. 45. Every fatality has been with the first dilatation, not the last. The mortality following gastrostomy is difficult to ascertain. I am afraid maximal mortality was in our own cases.

V.

THE ESOPHAGUS IN POTT'S DISEASE AND SCOLIOSIS.*

By LeRoy A. Schall, M. D.,

FROM THE DEPARTMENT OF LARYNGOLOGY, HARVARD MEDICAL SCHOOL,

Boston.

A thirteen-year-old girl with a large dorsal kyphosis due to Pott's disease, a patient at the New England Peabody Home for Crippled Children, swallowed a chicken bone that lodged back of the cricoid. As there was a good presentation, the bone was removed without difficulty.

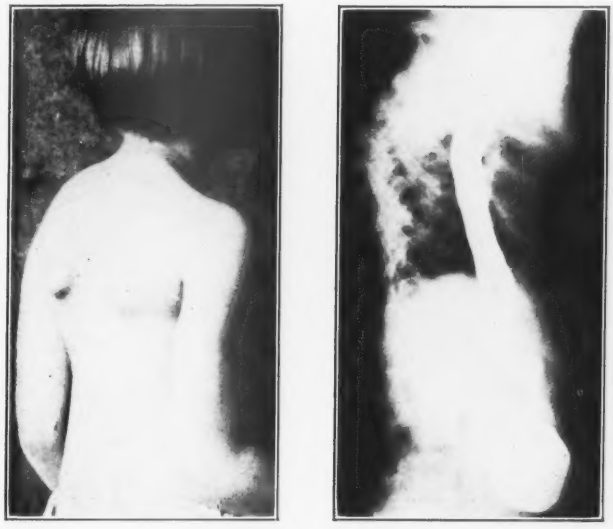
This case suggested the question as to the solution of the problem if the foreign body had lodged further down. What obstacles, in addition to spinal rigidity, would have been encountered that might have rendered the removal of the foreign body extremely difficult or impossible? This hypothetic problem is of practical importance, particularly to laryngologists connected with hospitals for crippled children, where a potential case may at any time become a reality.

The first consideration for the solution of this problem is the determination of the influence of a deformed spine upon the course of the esophagus.

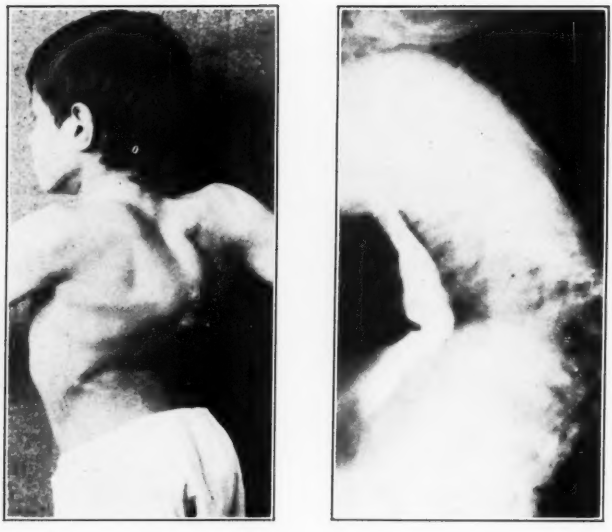
At the Harvard Medical School, among Dr. Mosher's collection of casts of the esophagus, there are two with kyphosis of the spine. In both, although the aorta follows the spine, the esophagus takes a straight course to the stomach. To determine whether this is the rule or the exception, forty-five patients with deformity of the spine, at the New England Peabody Home for Crippled Children, were subjected to a radiographic study of the esophagus. I am indebted to Dr. A. S. Macmillan for the roentograms and interpretations of this study.

*Read before the American Bronchoscopic Society, Montreal, May 29, 1926.

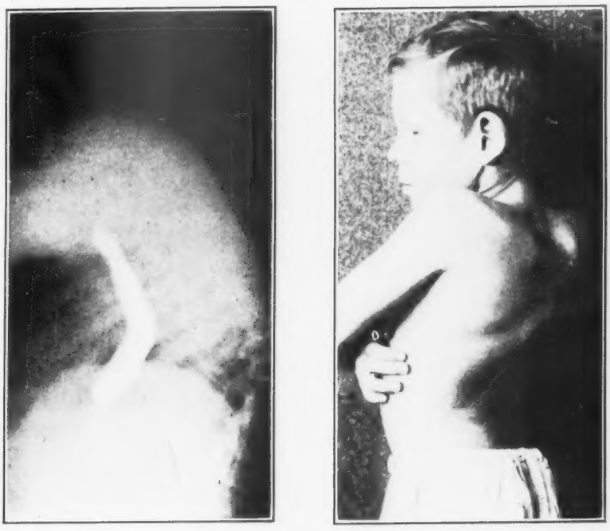
1. Annie S., age 10. Destruction of the fourth to twelfth dorsal vertebræ inclusive, due to Pott's disease. The direction of the esophagus conforms to the deformity of the spine. Its course is downward and backward to the apex of the kyphosis, where it turns forward at a right angle, following anteriorly on the undiseased vertebræ. The esophagus is dilated, and from the anterior surface at the angulation there is what appears to be a traction diverticulum.



2. Sadie S., age 12. Tuberculosis of the fourth to eighth thoracic vertebræ. The esophagus follows the spinal deformity, making at the apex of the kyphosis an angle of 130°. This esophagus is evidently not elongated but is slightly dilated.



3. Max V., age 13. Pott's disease involving the sixth to twelfth thoracic vertebræ. The esophagus is greatly dilated, especially above its 90° angulation at the apex of the kyphosis. On the anterior surface at the angulation there is what appears to be a constriction, although it may be due to a crease in a dilated esophagus folding upon itself. This esophagus follows the deformity of the spine.



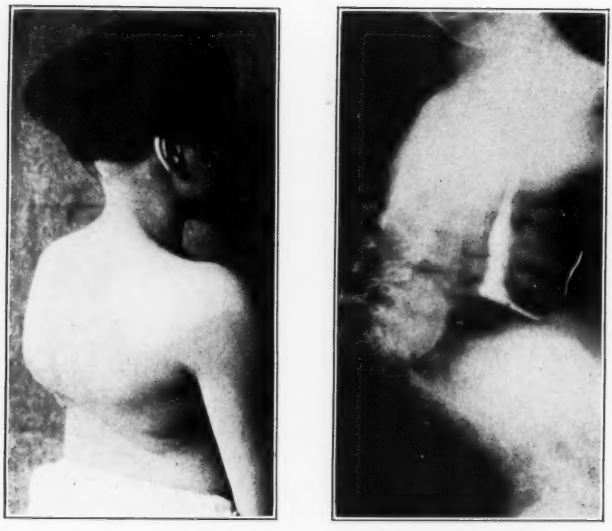
4. Harold C., age 12. Tuberculosis of the eighth to eleventh thoracic vertebræ, inclusive. Here again the esophagus follows the spinal curvature, forming a distortion angle of 113° at the apex of the kyphosis.

5. Veronica S., age 12. Pott's disease of the first to sixth thoracic vertebræ, inclusive. The esophageal angulation corresponding to that of the spinal deformity is that of 100°. This esophagus is dilated, particularly in its upper third, above the angulation.

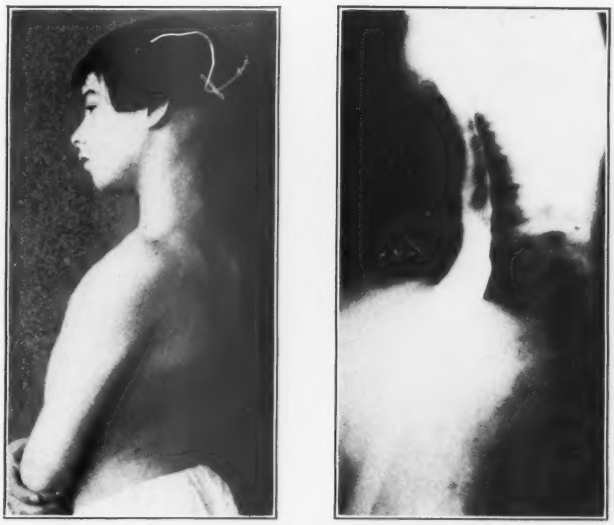
6. Bill W., aged 11. Left dorsal structural scoliosis with kyphosis. Deformity first noticed at three months of age.

6A. Large sausage shaped dilated esophagus which on the lateral view follows the kyphotic curve.

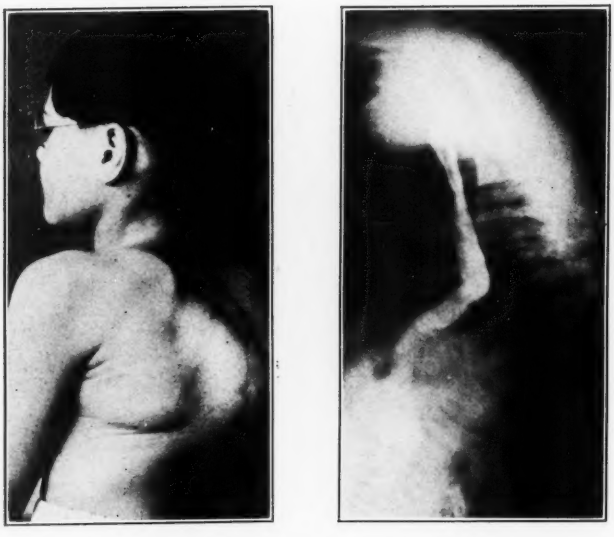
6B. The anterior posterior view shows deformity of the spine to the left and the esophagus descending down the right side of the vertebral column, following the curvature to the eleventh thoracic, where it crosses the spine to the left side to reach the esophageal opening of the diaphragm.



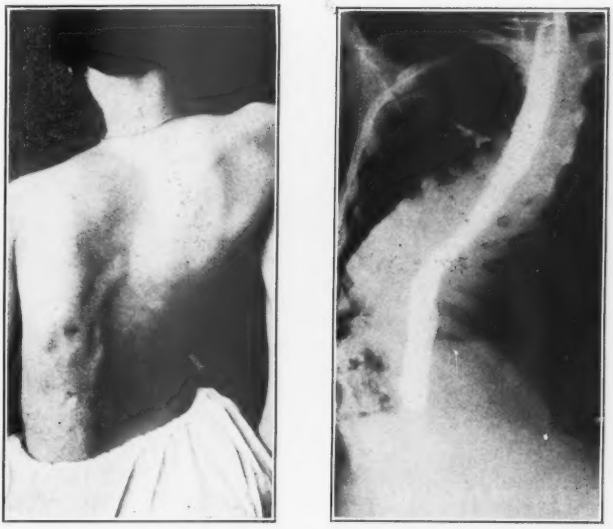
7. Ann C., age 14. Tuberculosis of the lower six thoracic vertebræ with a calcified cold abscess formation. The esophagus follows the spine to the tuberculous lesion, where it makes a 95° bend forward to go through the esophageal opening in the diaphragm. This esophagus shows no evident elongation or dilation. Posteriorly, from the apex of the esophageal angle to the sixth thoracic vertebræ there is what appears to be an adhesion.



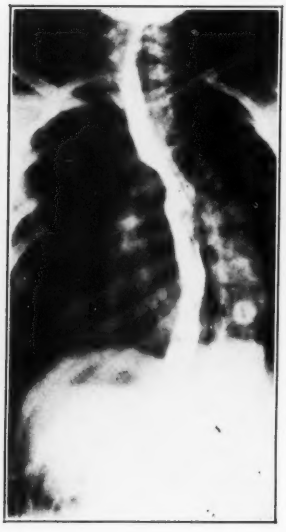
8. Edith K., age 15. Tuberculosis of the eighth to twelfth thoracic vertebræ. This lesion being low, does not influence the course of the esophagus. Although this esophagus is not elongated it appears to be somewhat dilated.



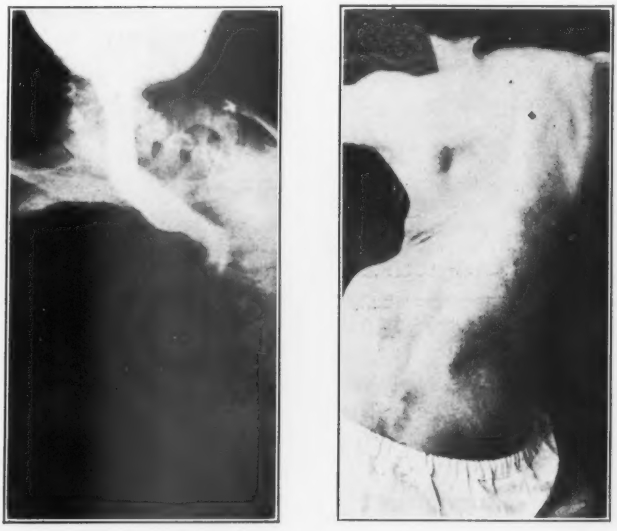
9. Alice P., age 14. Pott's disease of the lower six thoracic vertebræ, with the apex of the kyphosis at the eleventh. The esophagus forms an angle of 110° at the kyphosis. This esophagus is but slightly dilated.



10. Nellie M., aged 19. Infantile paralysis when two years of age. Paralysis involving the left side with consequent lack of normal development. This esophagus attempts to follow its normal bed in relation to the anterior surfaces of the vertebræ, but where the normal bed has lengthened and the esophagus has not, the esophagus is rotated off the vertebræ, forcing it to take the shortest course.



11. Mario L., age 11. Scoliosis of the spine, due to infantile paralysis when three years of age. The esophageal bed is lengthened, due to the scoliosis, with the esophagus rotated off.



12. Kenneth S., age 15. Scoliosis and kyphosis, due to infantile paralysis when three years of age. The esophagus follows the curvature of the spine, changing its course at the entrance of the thorax by making an angle of 130° to the right. At the apex of the kyphosis the esophagus turns downward, forming an angle of 120°.

CONCLUSIONS.

In patients with spinal deformities occurring in the course of the esophagus—

1. The esophagus tends to maintain its normal relation to the anterior surfaces of the vertebræ;

2. The complete filling of the esophagus with barium and the evident dilatation is suggestive of exaggerated twisting of the esophagus at the cone of the diaphragm;

3. Foreign bodies lodged in the esophagus above the apex of the kyphosis might be reached by oral esophagoscopy. If the foreign body is lodged below the apex, gastrotomy with retrograde esophagoscopy might be necessary for its endoscopic removal.

DISCUSSION.

DR. WOLFF FREUDENTHAL, New York: I had a case, six years ago, of a man, 30 years of age, with kyphosis and scoliosis. The patient was extremely difficult to manage, as he was in addition mentally defective. He had swallowed a foreign body. The point was that we had great difficulty in keeping the man quiet. Finally I was forced to give him a general anesthetic. This was done and we found the foreign body at the upper part of the esophagus.

DR. ELLEN PATTERSON, Pittsburgh: Dr. Jackson reported a case in "Peroral Endoscopy," 1914, of esophageal deviation associated with a spine deformed by a previously healed tuberculosis. A woman, aged 46 years, had a chicken bone in the esophagus which was removed by esophagoscopy without difficulty, but the marked deviation was so rare that a radiogram was taken. Doubtless, the esophagus had been dragged aside by the deviating spine, the dragging being facilitated by the longitudinal esophageal redundancy caused by the shortening of the straight distance from the hypopharynx to the hiatus. The deviation would not have been discovered if it had not been for the foreign body accident. There was no difficulty in esophagoscopy, notwithstanding a marked anterior as well as lateral spinal deviation. I think this paper of Dr. Schall's extremely interesting.

DR. P. P. VINSON, Rochester, Minn.: Did any of these patients suffer from dysphagia? I have never seen such a degree of dilatation of the esophagus without obstruction.

DR. GORDON BERRY, Worcester, Mass.: A patient with a marked kyphosis was referred to me for esophagoscopy because of difficulty in swallowing. Of advanced years, a carcinoma of the esophagus was suspected. The skiagraph could not rule out stricture. It was feared that a straight tube could not reach the lower end, but an examination half way down promised some help.

Under ether we were pleased to find that we could reach clear down to the diaphragmatic end. Here a beginning cancer was found. The significant anatomic point the examination brought out was: the loose attachment of the esophagus during its course through the thorax. This permitted its being lifted up from the sharp curvature sufficiently to let the straight tube pass along it to the lower end. At either extremity of the thoracic esophagus there is much less play.

DR. CROSBY GREENE, Boston: I think this is a very interesting and instructive paper. I have not examined the esophagus in cases with marked scoliosis or Pott's disease, but I have had cases with arthritis with a very stiff, rigid spine, in which it was difficult to pass the tube. I agree with the conclusions of the speaker, with a possible exception to the statement that it would be necessary to do gastrostomy in some cases. The attachments of the esophagus are so loose that I believe it will be found possible to pass the esophagoscope, even in rigid cases with marked deformity of the spine.

DR. L. A. SCHALL, Boston (closing): Answering Dr. Vinson's question, none of these children had any apparent difficulty in swallowing. In reference to Dr. Patterson's remarks, I do not know why more of these cases have not occurred. By the law of averages, some time someone will be called upon to face just such a problem, and I feel that the purpose of my paper will be fully accomplished if it awakens a realization of the difficulties that may be encountered.

VI.

GUMMATOUS STENOSIS OF THE TRACHEA—REPORT OF A CASE.*

By Robert M. Lukens, M. D.,

Philadelphia.

Syphilis of the trachea is relatively rare, and the majority of cases are of secondary lesions. Lewis A. Connor,[1] in 1903, published an exhaustive monograph on the subject of syphilis of the trachea and bronchi in 128 reported cases, and added one of his own, and of these case only twenty were tertiary lesions, which included gummatous growths and fibrotic changes due to healing.

Lloyd Thompson[2] states that Severinus (1580-1656) observed syphilitic involvement of the trachea, and Astruc, as early as 1736, wrote of an erosion of the trachea in a case of syphilis. Thompson further states that Munk, in 1841, was the first to ascribe to syphilis an etiologic rôle in a case of disease of these parts. Arrowsmith, in 1916, reported two cases of his own.

Chevalier Jackson[3] states that he has seen a few cases of syphilis of the trachea by bronchoscopy prior to 1908, and other bronchoscopists (Van Eicken, Kahler) many more. He cites two cases of syphiloma of the trachea which he observed bronchoscopically. One, in a man, 40 years of age, simulated a sessile benign growth on the right and posterior wall of the trachea, causing slight difficulty in swallowing and dyspnea. No bronchoscopic surgery was done, but the growth disappeared after a therapeutic test for syphilis was made. The second case he reported was a tumor of the trachea, which at first was thought to be tuberculous. He removed a specimen, which Dr. Willits examined microscopically and believed to be syphilitic. The tumor cleared up under antiluetic treatment.

M. C. Myerson[4] reported two additional cases before this Society in 1925.

---

*Read at the 1926 meeting of the American Bronchoscopic Society at Montreal, Canada.

Undoubtedly with the increased use of bronchoscopy as a diagnostic procedure in cases of chest symptoms of obscure origin, many more cases of tracheobronchial syphilis will be unearthed. Gumma of the trachea is an extremely serious condition, due to the production of progressive dyspnea and a tendency to sudden asphyxia.

Gumma may be single and may extend over a large area or may involve the entire circumference of the trachea, as in the case reported in this paper.

Breaking down of the gummatous tissue is rapid; ulceration is deep and may cause rupture of a large vessel resulting in fatal hemorrhage into the trachea or the mediastinum.

Pulmonary lesions associated with the tracheal lesion are most important. Syphilis of the lung may occur by extension. Pulmonary suppuration may be produced by interference with drainage, and in cases of cicatricial stenosis bronchiectasis may occur, although, according to the literature, this seems to be rather uncommon.

In the case reported here, evidence of pulmonary suppuration was coincident with the urgent tracheal symptoms.

The chief symptoms are cough, dyspnea, which is often paroxysmal, and stridor. The expectoration is often blood stained, purulent and fetid, and may contain fragments of sloughed tracheal cartilages. Dyspnea is usually associated with attacks of orthopnea and cyanosis.

Diagnosis in the nonstenotic cases can be made only by bronchoscopy in living patients. A very definite clinical picture is presented in the stenotic cases: (1) a peculiar type of dyspneic breathing in which the prolonged, labored and relatively slight inspiration and the shorter, easy expiration follow each other without the usual pauses; (2) a stridulous sound, chiefly or altogether inspiratory; (3) in most cases an inspiratory sinking in of the tissues of the root of the neck, the epigastrium, and the lower intercostal spaces (Connor[5]).

It is of vast importance to differentiate between a small saccular aneurysm of the arch of the aorta, which has eroded through the trachea and sessile tumors, syphilitic or otherwise, on the left wall of the trachea.

Pulsation may be present in either case, actual in one and transmitted in the other. The absence of expansible pulsation

is of no help, because there may be a clot in the aneurysmal sac, preventing expansion. Expansile pulsation is very difficult to determine by bronchoscopy, so that the taking of a specimen from a tracheal tumor, particularly in the region of the aorta, should be done only after very careful X-ray, physical and bronchoscopic study.

Treatment: Antisyphilitic treatment has been successful in a few cases. In the gummatous and fibrotic cases in which stenosis is the important feature, bronchoscopy is practically the only measure which will relieve the condition.

The prognosis is grave. The mortality in Connor's 128 cases was 76 per cent. Suffocative dyspnea caused death in eleven cases and in four death was due to hemorrhage.

REPORT OF CASE.

The patient, a colored man, aged 28, an oil compounder by trade, was admitted to the dispensary in August, 1924, complaining of hoarseness, which began five months previous, and productive cough, which caused soreness in the throat. One week before admission he expectorated small amounts of blood on three occasions. His general health had been good, except for typhoid fever in 1916 and a chancre in 1917. At this time the chest examination showed nothing noteworthy. X-ray examination suggested pulmonary tuberculosis. Laryngeal examination by Dr. W. Harry Barnes was as follows:

The voice was raucous and the general color of the larynx pale with congestion of the vessels. The epiglottis was mottled and ulcerated. A papillomatous growth was present on the right cord. A preliminary diagnosis of tuberculous laryngitis was made, based upon the appearance of the larynx and the suggestive X-ray findings. The diagnosis was changed to syphilis of the larynx after three examinations of the sputum were negative for tubercle bacilli and a plus four Wassermann blood test.

The papillomatous growth was removed and sent to the laboratory, which reported the specimen to be a papilloma. Neosalvarsan was administered, but was not followed up by further general antiluetic treatment. The laryngeal condition

improved and the voice became clear. Improvement continued for several months, and then his voice gradually became hoarse again, and the larynx and palate underwent destructive changes. Gradually increasing dyspnea accompanied the return of the laryngeal symptoms.

On April 8, 1925 (eight months later), sudden extreme dyspnea developed, and the patient was rushed to the hospital in what apparently was a dying condition. Breathing was extremely difficult, marked cyanosis was present, and the patient was bathed in a cold sweat. An emergency tracheotomy was done and a No. 6 tracheotomy tube tried. This tube should have entered easily but could not be inserted. A No. 4 was then inserted with difficulty, but went in only part way. The dyspnea was relieved to a certain extent but not completely.

Pretracheal fibrosis was so thick that tracheal rings could not be identified. The larynx was almost completely occluded. Large quantities of whitish, flocculent, purulent material were continuously coughed through the tube, frequently obstructing it, requiring changing of the entire tube several times daily.

Physical examination, April 8, 1925, after tracheotomy was performed, showed impaired resonance in both lower lobes, more marked on the left side. Breath sounds were tubular over the left lower lobe, with a few fine crackling räles. X-ray examination showed a marked infiltrative process in both lower lobes, dense enough almost to suggest consolidation, the opinion being that it was an acute infection, which was confirmed by subsequent bronchoscopy.

Gradual improvement occurred with decrease of the amount of sputum coughed up. Potassium iodid and mercury were administered in large doses.

On April 25, 1925, direct laryngoscopy revealed subglottic occlusion of the larynx, preventing peroral bronchoscopy. A 7 mm. bronchoscope was then inserted through the tracheotomy wound and was obstructed 7.5 cm. below the notch of the thyroid cartilage. The obstruction in the trachea was granular and pale pink in color. The upper portion of the mass had a cylindrical lumen, which had been reamed out by the tracheotomy tube. At the bottom of the mass was an opening to the right of the center, 3 mm. in diameter. An enormous

amount of pus was evacuated by means of an aspirating tube through this opening.

The lumen of the gummatous mass was increased by using the bronchoscope as a reamer. The lower border of the mass was reached 10.5 cm. below the notch of the thyroid cartilage. There were no further obstructions in the trachea or bronchi. The mucosa below the mass was found to be somewhat edematous and inflamed after all the pus was removed. A No. 5 cane shaped tracheotomy tube, when inserted, reached below the gummatous area and relieved the dyspnea completely.

Recovery was uneventful under intensive antiluetic treatment and bronchoscopic drainage through the tracheotomy wound. The stenosis above the tracheotomy wound would not permit peroral bronchoscopy until six months later, when a 7 mm. bronchoscope was passed with slight difficulty through the larynx.

At the present time healing is taking place, but cicatricial contraction grips the tracheotomy tube to such an extent that no air passes around the tube and through the larynx.

Recently I had No. 5 cane tubes made with a fenestrum in the curved portion on a line with the straight portion of the tube, which permits breathing through the mouth. The patient is now able to talk with a fair amount of ease by putting his finger over the tracheotomy tube.

COMMENT.

1. While reported cases of syphilis of the trachea are comparatively rare and many of them are diagnosticated at autopsy, it is probable that many more cases occur. With the development of bronchoscopy, however, it is probable that lesions of syphilis will be seen in a fair percentage of cases of oral and tracheal syphilis.

2. Early diagnosis of tracheal and laryngeal syphilis by the bronchoscope would tend to prevent such serious conditions as extreme or sudden dyspnea due to gummatous or cicatricial stenosis of the trachea, necessitating emergency tracheotomy.

3. Biopsy in tumors of the trachea should be performed only with the greatest caution because of the danger of rupturing undiagnosticated aneurysmal sacs, thereby producing fatal hemorrhage.

REFERENCES.

1. Lewis A. Connor: Amer. Jour. Med. Sci., 1903, CXXVI, 57.
2. Lloyd Thompson: Text Book on Syphilis, 1920.
3. Chevalier Jackson: Peroral Endoscopy and Laryngeal Surgery, pp. 434 and 485, 1915.

Chevalier Jackson: The Bronchoscope as an Aid in General Diagnosis. Archives of Diagnosis, April, 1908.
4. M. C. Myerson: Laryngoscope, March, 1926.
5. William Osler and John W. Churchman: Osler and McCrea, Modern Medicine, Vol. II, chap. 6.

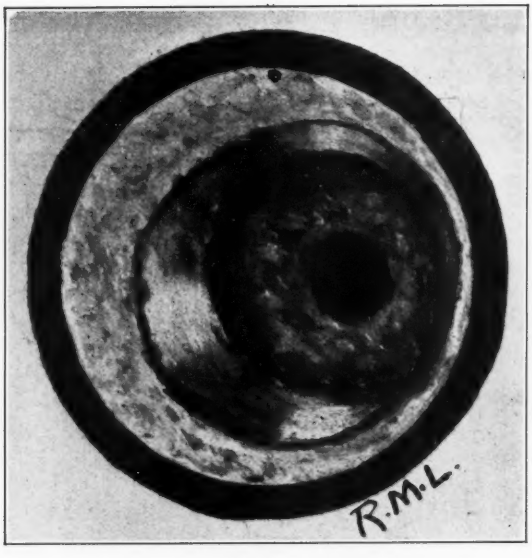


FIGURE 1.

Bronchoscopic sketch of the gumma of the trachea. The gumma extended from 7.5 cm. below the thyroid notch to 10.5 cm. below the thyroid notch. The smooth-sided cylindrical excavation was caused by the cutting pressure of the emergency tracheotomy tube. Below is the stenosing mass showing the lumen, which is 3.0 mm. in diameter. At bronchoscopy, this whole mass was reamed out by rotating the bronchoscope, much in the same manner as an apple is cored.

DISCUSSION.

DR. S. IGLAUER, Cincinnati: At the present time I have my first case of gumma of the trachea under treatment. The history is interesting. The patient went to California and returned suffering from dyspnea attributed to crossing the great divide. The dyspnea continued for several months. The patient was then brought to my office with very marked obstruction to breathing. A bronchoscopy was done, and just above the bifurcation there was a mass on the left side occupying two-thirds of the lumen of the trachea. I thought it was a neoplasm. A small piece was removed for examination. The pathologist reported that it was a gumma, and the Wassermann showed 4 plus. With this diagnosis I thought the proper thing was an intensive iodid treatment, and I gave large doses of iodid. She developed an extreme dyspnea, which I thought was partly due to an overdose, the local reaction closing up the trachea. A tracheotomy was performed and a cane shaped Jackson cannula was inserted. The patient found it uncomfortable and we substituted a piece of a stomach tube for the tracheal cannula. The rubber tube was held in place by a safety pin inserted through its proximal end, with tapes passed through the safety pin and tied about the neck. The patient wore this for some time. I left the city, and while I was away the interne removed the tube and the patient breathed through the mouth for about three weeks, when extreme dyspnea demanded secondary tracheotomy. She is still wearing the rubber tube, which tends to dilate the stricture. Her daughter takes the tube out, cleanses it and is able to take care of the patient. One curious point was that after the gumma had disappeared the trachea had lost its consistency at the site of the gumma—i. e., there was a chondromalacia of the trachea. The trachea had a tendency to be sucked in during inspiration. Later cicatricial tissue formed at the site of the gumma and the trachea became more rigid.

Eventually I hope to get rid of the rubber breathing tube entirely with the restoration of buccal breathing.

DR. D. CROSBY GREENE, Boston: One point should be mentioned in regard to dyspnea. I understood Dr. Lukens to say that a characteristic of the dyspnea of gumma of the trachea

was the prolonged stridorous inspiration and short expiration. I think the character of the dyspnea is an important diagnostic point. When the obstruction occurs above the thorax the dyspnea is inspiratory in type, and when below the neck it is expiratory. I believe that in Dr. Lukens' case the dyspnea was inspiratory in type, because there was obstruction in the subglottic region as well as lower down in the trachea. Administration of iodids in these cases of tertiary syphilis sometimes causes extreme dyspnea. For this reason they should be kept under close observation so that emergency tracheotomy may be done if necessary.

DR. WM. B. CHAMBERLIN, Cincinnati: Dr. Lukens' attempt to do a tracheotomy in this case strikes a sympathetic cord in my breast. I tried in one case and I thought I would never get into the trachea. The lumen was very small and there was marked peritracheal thickening. When there is extreme thickening of the trachea it makes it very difficult to perform a tracheotomy.

DR. R. M. LUKENS: This patient was not mine for the first part of the treatment. Dr. Barnes works with the negro patients at Jefferson, and was treating this man for syphilis of the larynx. He was brought into the bronchoscopic clinic and we thought that he had some laryngeal obstruction; therefore, we did tracheotomy. We had great difficulty in getting the tube in because the walls of the trachea were very thick. We had to resort to a No. 4 tube. We kept the suction pump going continuously drawing the pus from the trachea. We did a subsequent bronchoscopy because the gumma was discovered. As to use of potassium iodid—in Dr. Jackson's clinic we do not use potassium iodid in laryngeal cases because it is apt to produce sudden edema. If the trachea is open we are not afraid to use it, because then edema of the larynx is not so important.

VII.

THE TREATMENT OF ANTRAL DISEASE BY SIMPLE TUBE DRAINAGE.

By R. E. Mercer, M. D.,

Detroit.

This is a study of the results of simple tube drainage in antral disease in 230 cases. The method used was to make a trocar opening from the nose into the antrum in the inferior meatus, inserting a small curved tube and leaving it in situ for some time. In the nasal end of the tube a rubber or metal wash tube is inserted for washing out any pus or secretion present, and through it such medicaments as are deemed best may be readily instilled. It also serves for constant free drainage and aeration at all times.

Have used these tubes in antral cases for more than fifteen years and presented them to the Laryngologic Section of the American Medical Association in 1916. They are made of silver, soft and malleable, so as to be bent to fit comfortably with ease. Are made in five sizes and find the ones with a smooth pointed end and two side openings easier to insert, but often use one with an open end the first time as having a more direct and forcible flow. The proximal end of the tube is enlarged like an eustachian catheter but with rounded edges so as to be comfortable for the wearer. This enlarged end prevents the tube from slipping into the antrum. The distal end is curved to about a 90 degree arc. The larger tubes are about 2¼ inches over all and the smallest about 1⅛, varying between these two sizes. The diameters vary from about 9/64 to 4/64. The metal wash tubes are curved with a tapered end for insertion into the larger end of the antral tube, and the soft rubber tubes, which are given to the patient to use at home, have a simple straight taper with the large end big enough to slip over the rubber tip of a fountain syringe.

In 1917 I reported a previous series of cases to the Detroit Otolaryngological Society, which had been treated by the same

method. This series extends from then to July 1, 1925. Of the 230 cases, 103 were males and 127 females. The average age was 34, the youngest 8 and the oldest 71; 11.5 per cent were over 50, and 5.5 per cent were under 20; 49, or 21 per cent, were acute and 181, or 79 per cent, chronic; right, 45 per cent; left, 55 per cent.

Of the acute cases 88 per cent showed pus macroscopically and were followed to conclusion. The tubes were kept in practically all from seven to eight weeks, a very few being removed earlier and all were cured. That is, the flow of pus ceased, frequently very shortly after drainage was established, and transillumination was clear. The reason for leaving the tubes in longer than really seemed necessary was that in the previous series we had found that early removal of the tube caused a number of recurrences. In this series, in the acute cases we had only three recurrences, one after eight years and had to have a radical, and two had mild recurrences, which cleared up in a few days. Six were not followed up because of not returning to the office and we were unable to get any report on them. As they had wash tubes for insertion into the antral tubes for home treatment, they may have been cured, but we do not know, and so they are classed as failures.

In the chronic cases two had radical antra later. In both the tubes were left in for four months without relief from the discharge. Three others were advised to have radicals. Six were unimproved and there were seven recurrences in from one to three years. Seventeen were lost sight of and cannot be reported as to final results. Of these one gave a history of antral trouble for thirteen years, was treated for three weeks with marked improvement; one of three years was also much improved when last seen. This leaves 146, or 80.6 per cent, of the chronic cases that can be definitely reported as cures. As in the acute cases, there is also probably a fair percentage of cures in those lost sight of, but they are all considered as not improved.

PAIN.

About 30 per cent complained of pain to some extent, and 4 per cent complained of severe pain over the cheek. About 20 per cent had some headache.

DISCHARGE.

Twenty-eight per cent had nasal discharge and about 8 per cent gave as the principal symptom postnasal dropping.

Two had marked laryngeal irritation as the principal symptom; both cured.

Two cases had otitis media. Thirty-six cases, or 15.5 per cent, showed ethmoid involvement.

Thirty cases, or 13 per cent, had middle turbinal resections on the same side.

Six cases, or 2.6 per cent, had submucous operations.

Eleven cases, or 5 per cent, had frontal sinus involvement, mostly antecedent to antral disease.

Transillumination was positive in 216 cases, or 94 per cent. Transillumination was negative and X-ray positive in 11 cases. Pus was found in 8 of these, none in 3.

In 17 cases no pus was found; of these cases:

1. The first had considerable nasal discharge, positive transillumination. The discharge ceased soon after the antrum was opened and the patient was cured.

2. Purulent nasal discharge, transillumination and X-ray positive. No pus found on inserting tube. Radical done by oral surgeon later, but patient was not relieved. Other sinuses negative.

3. Profuse nasal discharge, transillumination black but no pus found on opening antrum. Patient cured in 18 weeks.

4. Pain and tenderness over antrum, no discharge, transillumination and X-ray positive. Cured.

5. Headache, clear on transillumination, cloudy on X-ray; no relief.

6. Dusky transillumination, no pus, severe pain. Permanently (two years) relieved by injection sphenopalatine ganglion. No effect from antral operation.

7. Severe pain over antrum, much discharge, transillumination clear, X-ray dark. No pus found in antrum but pain was relieved.

8. Transillumination dusky, case of asthma, markedly relieved by pollen and vaccine. Antral treatment of no effect.

9. Transillumination clear, X-ray dark, no pus, severe pain, tube in three days with relief but patient disappeared.

10. Pain in cheek, face swollen, transillumination and X-ray dark, teeth negative, X-ray and dentist. Objective symptoms relieved but patient continued to complain. Menopause neurotic.

11. Headache, transillumination cloudy, X-ray negative, no pus, radical antrum full of polypi; cured.

12. Rheumatism, transillumination clear, X-ray cloudy, right frontal and ethmoid also involved; no pus found in antrum. Tube in for five weeks; frontal and ethmoid opened. Rheumatism relieved but some recurrence nine months later.

13. Severe local pain but no tenderness; marked headache. Transillumination clear, X-ray cloudy; left frontal and ethmoid opened also; tube in antrum 16 weeks. Cured.

14. Pain in neck for some years. Transillumination clear but as pain seemed to radiate from region of antrum, tube was inserted with the idea of possible negative pressure. No results.

15. Severe local pain and tenderness in left face. Transillumination slightly cloudy, X-ray clear. Tube inserted and most of pain relieved but not all.

16. Pain in both cheeks, local tenderness. Transillumination cloudy left; tube inserted, worn 20 weeks. Cured.

17. Local pain and tenderness. Transillumination clear, X-ray right antroethmoid cloudy; tube, submucous. Relieved; did not have to open ethmoid. Tube worn for eight weeks.

ETIOLOGY.

In 44 per cent of the acute cases was unable to arrive at any definite conclusions as to the etiology. Sixteen per cent gave a definite history of involvement of the teeth, or a dental X-ray showed the relation of a tooth root abscess to the antral disease. Acute rhinitis was the cause in 18 per cent. Chronic rhinitis in 6 per cent. Gunshot wound in one case.

In the chronic cases could find no definite etiology in 70 per cent. The teeth were causal in 9 per cent; chronic rhinitis in 5.4 per cent; influenza in 7.2 per cent; injury in 1.6 per cent; palatal abscess, scarlet fever and chronic tonsillitis, one case each.

BACTERIOLOGY.

Only part of the cases were examined bacteriologically; of these, 16 showed diplococci, 12 streptococci, 13 staphylococci,

8 diphtheroids, 1 each colon, micrococcus catarrhalis and bacillus ozena. Seventeen showed a mixed infection.

ASTHMA.

There were ten cases with asthma, four had chronic antro-ethmoid disease, both antra and ethmoids being operated upon. The other six cases had chronic antra only. Two cases did not return and no follow up records were obtained. Two cases were markedly improved, but the other eight cases were not benefited by the operation so far as the asthma was concerned.

BRONCHITIS.

Of four cases of chronic bronchitis, for which no cause could be ascertained except the chronic antral disease, the tubes were worn from ten to fourteen weeks with a cure in three cases and marked improvement in the fourth.

POSTNASAL DROPPING.

There were 19 cases which gave postnasal dropping as the chief cause of camplaint. Of these, 6 were cured, 5 much improved, 2 improved, 1 not improved, and the result unknown in 5, making 6 classed as not improved, or 30 per cent, with 70 per cent improved to cured.

RHEUMATISM.

Cases of chronic antra and rheumatism. There were nine cases; three were complicated with ethmoid and two with frontoethmoid disease. Results in the chronic antra alone were good in each of the four cases seen.

In the five cases where the antral was complicated by ethmoid or frontoethmoid disease, in each case the other sinuses were operated upon in addition to the antra, but there was no benefit in any case.

One case with multiple neuritis showed considerable improvement after operation, as did two cases of chronic laryngitis.

DIFFICULTIES.

The operation is practically the same as ordinary aspiration of the antrum. Occasionally the wall is heavy and a drill is necessary to get through, but usually the trocar is easily inserted, withdrawn and a tube put in its place. One should be

chosen which will fit comfortably, the proximal end resting just within the vestibule on the nasal floor. As a rule, it causes little or no discomfort, the patient forgetting its presence after a day or two, except when it is necessary to wash out the antrum. Occasionally, especially if the opening is made rather high, the tube has a tendency to slip out, retention being difficult if the head is bent forward. In that case a little bulge made near the end of the tube will prevent its slipping forward through the opening.

The average time for leaving the tube in has been eleven weeks. In three cases in this series, where the tubes were removed in from one to three weeks, the patients were relieved for the time but had recurrences in each case.

On the other hand, cure may be long delayed, but eventually follow the prolonged wearing of a tube. In one case cure was obtained after 52, and in one case after 48 weeks. As a general rule, however, if four months go by without improvement in the condition of the antrum, a radical is advisable.

This report aims to give a true synopsis of the facts in this series of cases and let them speak for themselves. There was no selection with the idea of improving statistics, but the cases were taken as they came, and those which were lost sight of, or where the results were unknown, have been classed as failures, so that the good results are at least not overstated.

CONCLUSIONS.

1. That as far as these records go, a large proportion of antral cases are not secondary either to disease of other sinuses or of the teeth.

2. That simple drainage and aeration are effective in curing 85 per cent of all cases, and if the ones that were not followed up are omitted, instead of being classed as failures, about 94 per cent.

3. Asthma, ten cases only; antral disease is very rarely a causative factor, and antral operative work is of little value in relieving.

4. Bronchitis; antral disease may be a causative factor in some obscure cases, and antral drainage may be curative.

5. The antrum may be a source of focal infection in rheumatism but few cases, less than 5 per cent, of antral disease

complain of rheumatism. In those that do an operation may have decided value.

6. Postnasal dropping may be caused by antral as well as by other sinus disease, and operative treatment may give relief.

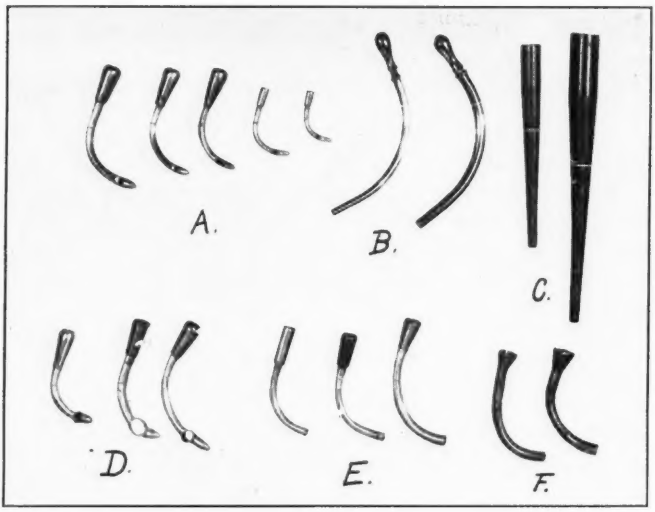
ADVANTAGES.

Over repeated punctures, permits constant aeration and drainage is less painful for the patient and less troublesome for the operator.

Over window opening, permits home treatment and is rather more simple.

Persistent use of the tube will render a radical operation unnecessary in a great majority of cases. This is true not only in chronic purulent antral disease, but also where there is hyperplasia of the antral mucosa.

There were no untoward symptoms from or following the operation in any case; no air was injected; the operation is simple and safe.



A. Present tubes, actual size.
B. Wash tubes, metal.
C. Soft rubber wash tubes for patient's home use.
D. Bulged end retaining tubes.
E. Open end tubes.
F. Original tubes, pure tin. All other tubes, pure silver.

VIII.

SOME OBSERVATIONS ON SINUS DISEASE IN PRIVATE PRACTICE.

By Gordon F. Harkness, M. S., M. D.,

Davenport, Iowa.

Someone has stated that at the present time only the very poor and those whose social status is far above the average have access to all that scientific medicine has to offer. By far the larger number of rhinologists are in private practice, and to their care is entrusted this large middle class. It is the increased cost of scientific medical care that is the force behind the movement for socialized medicine. The practical application of our knowledge in private practice must of necessity recognize economic factors as they apply to each individual. In other words, the pathologic condition present is not the sole arbiter as to the procedure to be followed. The economic condition of the patient, his ability to carry out a general health regime, and his residence as offering the possibilities of continued contact with him are all factors that govern one's procedure.

The nasal accessory sinuses present problems which are characteristic of them alone. Their frequent anomalous extensions, as shown by Shafer, Prentiss and others, may of themselves, or combined with the configuration of surrounding parts, make them inaccessible to surgical procedures through natural orifices. The one constant factor is that they are all air chambers, which are most intimately associated, not only because of contiguity of tissue but also because of the arrangement of openings through which the air is able to reach the individual sinuses. The permeability of these ostia, and thereby the maintenance of drainage, is of first importance in carrying on physiologic functions.

Histologically we differentiate the respiratory and olfactory parts of the nose. The latter is often not given the consideration it deserves when operative procedures are contem-

plated. The lining membranes of the paranasal sinuses are extensions from the nasal cavity, and differ particularly in the thinness of the basement membrane and tunica propria, the close adherence of both to the periosteum, and almost practical absence of glandular elements except around the ostia, particularly of the sphenoid and maxillary sinuses. In spite of the thinness of this membrane, it readily thickens when inflamed, particularly about the ostia, where its adherence to deeper structures is lessened. This is a factor in the interference with natural drainage.

There is a physiologic force that shapes the symmetry of form in utero and continues to exert its influence postnatally. This is exemplified in the development of the sinuses after birth. Osteoblastic and osteoclastic activities work simultaneously under a normal physiologic governing force. It is well established that interference or anomalous hyperactivity of these forces may be inaugurated by inflammation of the neighboring mucous membranes. In fact, Shea and others have demonstrated the resumption of normal physiologic forces after simple drainage of an infected sinus.

Jonathan Wright states: "It would probably be difficult to find an adult individual in temperate or cold climate who does not present an example of these bone changes (osteoclastic and osteoblastic) within his nasal chambers which we have a right to call pathologic. It is only exceptionally that the symptoms to which they give rise are sufficient to cause him to seek relief."

The clinical interpretation of the appearance of the nasal mucosa as to a distinct pathologic entity frequently offers great difficulty. It would seem that the standard classification of inflammatory conditions are but steps in one process beginning with frankly acute to manifestly hyperplastic inflammations. The symptomatic effect upon the patient in all conditions, excluding gross nasal cavity obstruction, is due to one cause, obstruction to drainage from air chambers. This cause may vary from obstruction due to gross hyperplasia, accompanied with polypoid formations, to the less manifest types which are just as effective in closing minute ostia. Suppurative sinusitis endangers the patient's welfare in proportion to the increasing

lack of drainage from the cavity involved. This rule applies equally well when nonpus producing organisms are sealed off. Closed infections may insidiously and seriously affect the general health, without manifestly affecting contiguous tissues, to a degree that causes subjective symptoms. We have the counterpart in the deep closed abscesses of the faucial tonsils and the apical abscesses of devitalized teeth. The effect of drainage upon such closed foci of infection, without the removal of the host, has recently been demonstrated by von Lockum of the Mayo Clinic in his work on the prostate. He has, in patients with normal urine, by massaging the prostate, been able to open up closed foci of infection and later demonstrate the infection in the urine. By continued massage alone he has accomplished some very marvelous results. The unfortunate locations of the drainage ostia, particularly that of the sphenoid and antrum, have long been recognized. The clinical verification of this has been very forcibly brought to our attention in the work upon the antrum in sinus disease of childhood, where an artificial opening in a more favorable location has brought about relief from general and local symptoms. Certainly aeration with free drainage of the paranasal sinuses is the desideratum. Whatever our theories may be, we are measured by the end results of our clinical procedures.

It has been my observation that men entering private practice from clinical centers become less radical in their initial operative procedures as their experience in this field of practice progresses.

Perry Goldsmith of Toronto made what was, to me, a significant statement at one of our meetings. He has kindly corroborated the statement, as I had remembered it, by the following letter:

"Before I went away to the war I had under treatment many patients who had ethmoiditis, suppurative and nonsuppurative, at any rate, there was a chronic edematous change in the ethmoid mucosa. Upon these patients various conservative measures were carried out, removal of the protruding polypus, and removal of the anterior portion of the middle turbinate, while in others an opening was made into the ethmoid labyrinth without extensive ethmoid curettage. Had I remained home

probably further measures would have followed. On my return I was impressed with the fact that those who had nothing more done to them were, on the whole, better than those who had further measures carried out by others in my absence.

"This has led me to the view that early ethmoid changes should not be associated with extensive ethmoid surgery, but if the ethmoid labyrinth becomes a mass of chronic edematous mucosa, liable to frequent acute edematous changes, to what we call cold or some infection, then widely exposing the mucosa of the ethmoid labyrinth to the air will usually be required. I am satisfied that the socalled hyperplastic ethmoiditis, when during a 'cold' one sees edematous buds, even quite sizable polypi protruding about the middle meatus, anteriorly and posteriorly, and then entirely disappearing, leaving the nasal meatuses quite within normal limits, is primarily due to a special type of irritant within the patient himself. What this is I do not know, but Neil McLay's and Dale's work on guanadine in the bowels seems to offer hope of solution."

Clinical procedure, to be justified, must be based on the end results as expressed in the patient's comfort and well being. One may be classed a conservative, and yet recognize individual cures in which only radical procedures are justified. The largest group of patients suffering from paranasal sinus disease is the chronic catarrhal class. And I believe the radical surgery that has been practiced upon great numbers of these patients stands to the discredit of our profession.

The lining mucosa of the accessory sinuses is individualistic in anatomy and physiology. The various types of inflammation may coexist and represent stages in a continuous process. They are really not entities in themselves. Trauma inflicted upon the mucosa may give rise to an infective osteitis, which will progress independently. Radical surgery never leaves a normal nasal cavity. The effect of climatic change may not restore the mucosa to a normal histologic condition, but the fact that the individual is relieved of symptoms bids us pause and consider this factor. I have relieved some patients simply by correcting the methods by which they were heating their dwellings and instructing them how to humidify the air in their homes.

The nutritional factor is another which has been overlooked until the last few years. The pediatrician working in a hospital will accomplish astonishing results while the child is under his personal supervision. He does not retain these good results after the child leaves his personal hospital care, and this is the same obstacle that we in private practice meet. Hospitalization of these children, from the nutritional standpoint, is only possible in exceptional cases. Nutrition in private practice is a factor, but its practical application is largely a failure.

Acute sinusitis is very common and generally self limited. It manifests itself symptomatically when an obstruction is offered to normal drainage. Hence reestablishment of drainage is the objective. Radical surgery is, of course, contraindicated except in the presence of complications when neighboring tissues are invaded. The patients should be bed patients, but as a rule they will not and can not. Doctors are no exceptions. Contrary to the advice given by most authors, I have found the secondary reaction to the use of suprarenal extracts so often outweighing the beneficial result of the primary shrinking of tissue that its use is routinely contraindicated. Dependence for shrinking of the tissues is placed upon cocain solutions applied topically by means of the thin cotton pledget. Free and repeated use of this for years has never shown the least tendency to a narcotic habit by the patient. The use of the spray in any form is just as strongly contraindicated, because of known instances where its ease of application has led to dire results.

The white diagnostic lamp continues to be a fairly reliable guide, as regards the frontal and maxillary sinuses in acute conditions, except for absence of a sinus.

Suction may defeat its purpose by the too sudden withdrawal of the suction tip, since infected material may be forced into cavities in which a partial vacuum has been produced. The appearance of purulent material after suction depends largely on whether the draining ostium has been dependent to the cavity during the operation, hence the advisability of turning the head ninety degrees to the opposite side when a maxillary antrum is involved.

Siphonage of the nasal cavities has been found to be a valuable aid. This applies to acute as well as to chronic inflammatory conditions. Lavage does not accomplish the same purpose. The long tube to the floor actually pulls the fluid, normal salt or soda bicarbonate solution, through the nasal chambers. It acts like the water vacuum pump, and the suction effect is easily increased at intervals by pinching the inlet tube. Babies can be wrapped and placed face downward on a high table, and children gain the advantage of the long outlet tube by standing on a chair.

The packing of the nose with various silver preparations and dyes has not given the results in my hands that others have claimed for them. Packing, if attended with trauma, does more harm than good. Repeated spraying as an office procedure has seemed preferable. Patients handle sprays poorly. Having the patient flat on his back, dropping a few drops of the solution into the nose, and at the same time quickly snuffing is easy of accomplishment and carries the solution to the desired areas. There are certain esthetics that might be applied in using solutions. Those of deep and disagreeable staining qualities are used quite frequently when they really have little if anything to offer over those not having these undesirable qualities.

The maxillary and sphenoid sinuses are at a particular disadvantage because of the position of their draining ostia. The former is probably our most common offender, not only in causing discomfort, but in harboring latent concealed infections, which affect surrounding tissues and also the general health. Persistent efforts to reestablish drainage through the natural ostium have never seemed very logical to me. Probing without undue trauma is often impossible; the sole avenue of drainage remains in an unfavorable locality, and if an enlarged opening for drainage is made here, one increases the chances of this cavity acting as a receptacle for material coming from the frontal and anterior ethmoid sinuses.

Drainage or evacuation of purulent material through the inferior meatus offers a favorable position as regards the sinus cavity. It is easy of accomplishment and can be made practically painless. I have felt that the needle puncture as a

diagnostic measure had the advantage only in those cases where nonpurulent infection was suspected, and it was desired to examine the washings from the sinus according to Dean's method for the presence of infecting microorganisms.

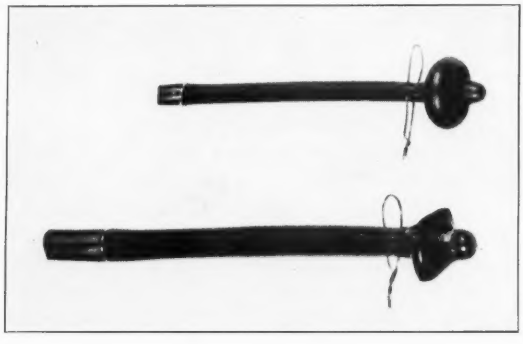
The larger calibered trocar, such as the Pierce, with a handle that assures absolute control of the instrument, has the following advantages: its use need not be attended with any more pain, there is a freer outlet for the evacuation of thick pus, and the opening made of itself will often maintain drainage. If obstruction is offered to the return flow of an irrigating solution, the caliber of the trocar is large enough to allow the introduction of a fine tube, with the return flow coming back around it through the trocar. The size of the opening made is large enough to permit subsequent treatments to be made, and through it valuable knowledge can be gained as to the state of the lining membrane by means of a probe or cotton tipped applicator.

The dangers of antrum irrigation are largely a matter of faulty technic. The trocar should have a very sharp point to avoid pushing the lining membrane before it after piercing the bony wall. Secondly, there should be an avoidance of any undue force in using an irrigating fluid. Knowledge of obstruction and control of the force used is best gained by the rubber bulb, two valve irrigating tube. Removal of the remaining fluid in the antrum cavity by suction is preferable to air inflation, particularly since the use of air has seemed to be a factor in most of the reported cases when unfortunate complications have occurred. In acute cases irrigations are contraindicated with the subsidence of symptoms, regardless of the fact that the washings may not be clean.

Bactericidal solutions seem efficient once drainage is reestablished, inefficient without drainage, hence the conclusion that reestablishment of drainage is the important factor. In fact, reestablishment of drainage does very well without antiseptic solutions.

The use of minute doses of atropin, 1/2400 gr., every one-half hour is an aid in acute conditions, in checking glandular activity without a disagreeable dryness. The position of the glandular elements about the ostia makes their reduced activity desirable in furthering drainage.

The continued maintenance of drainage with the least trauma offers a problem for which various means have been devised, as gold and silver tubes, with self retaining features. The tissues tolerate rubber well and, due to the difficulties of having perhaps a more desirable type made, I have borrowed from the genitourinary surgeon (see illustrations). For the maxillary antrum the Pezzar self retaining catheter, size according to the individual case, with part of the bulbous end cut out, and of about three-eighths of an inch in length, serves the purpose. To prevent its slipping into the antrum, a guard of silver wire is made, varying according to the size of the



opening. This wire, 925/1000 sterling, size 43/100 minimum, pierces the catheter tube wall at right angles on opposite sides. The sharp end is cut off and the two ends twisted together and flattened fairly smooth. This self retaining drainage tube is then inserted through the enlarged inframeatal opening, a curved applicator or probe being first inserted through the tube to the tip, to give the necessary rigidity. The tube, after the probe is withdrawn, can be worn as long as desired, with a minimum of discomfort. It offers adaptability in size, according to the patient and the desires of the surgeon; it is simple, and, above all, it maintains drainage and aeration. This same catheter has possibilities in maintaining drainage from the frontal sinus, particularly after an external operation.

Chronic sinusitis and parasinusitis constitute the most baffling problems. Time does not permit nor has there been any desire to outline specific procedures for types of clinical cases. If I may be permitted to speak for those in private practice, those who are living with their patients, it has seemed that our literature has stressed radical procedures to the point of overshadowing consistent conservative nasal surgery. A deflected septum, besides being an irritating factor in augmenting a hyperplastic rhinosinusitis, often prevents any possibility of conservative nasal surgery. Its removal does not sacrifice anything and gives the space absolutely essential to good nasal surgery. Permanent inframeatal drainage of the maxillary antrum will exert a beneficial effect upon ethmoid cells of the anterior group which show chronic changes.

The maintenance of drainage from the diseased ethmoid labyrinth is difficult. There is a marked tendency to the formation of scar and hyperplastic tissue after operation. The opportunities for blockage from this source are greater with the middle turbinal remaining in situ. Yet the importance of the middle turbinate and the mesial wall of the ethmoid labyrinth, from the standpoint of olfactory function, the physiologic function of the middle turbinate, and the middle turbinate as a landmark if nonsacrificing surgery fails, are sufficient to warrant surgery of the ethmoids, with the middle turbinate remaining in situ in many cases.

The anatomic barrier between the ethmoid cells of the anterior and posterior group is not constant in thickness or position. It is disregarded in radical surgery, so the inability to definitely locate this bony wall does not constitute a contraindication to working under the middle turbinate. Even with evidence of postethmoid and sphenoid involvement, particularly if the septum has been resected, it is often possible to enlarge the ostium of the sphenoid to promote drainage without removing the middle turbinated bone.

While there is no question as to the necessity of removing en masse the diseased lining membrane in some maxillary and frontal sinuses, a moderately thickened membrane alone does not demand this if we can maintain after drainage. Scar tissue takes the place of a membrane that has been totally removed.

It is possible for after drainage so favorably to affect a thickened membrane that it will function better than scar tissue. We have learned to respect the lining membrane of the sphenoid cavity, largely because of its anatomic relationships, and, with free drainage and conservative removal of lining tissue, have gotten along very comfortably.

The Caldwell-Luc operation, which is the personal choice of the author, gives one the opportunity to inspect and decide what tissue demands removal. Yet it is not the removal of this tissue alone that gives relief, for without free and permanent after drainage through the inferior meatus, there would be small chance of success. The inability to maintain drainage through the nasofrontal duct is the great obstacle to a successful termination of a frontal sinus operation, as a review of the various types of operations proposed will substantiate.

The suppurative hyperplastic type of pansinusitis, which resists all radical intranasal surgery, in fact seems to progress at times following intranasal surgery, is not really a sinusitis per se. Drainage here is not a factor. It seems logical to conclude that the condition present is really an infective osteitis of the external wall of the ethmoid labyrinth. The brilliant results reported by Lynch, and particularly corroborated by some of his Southern colleagues, in which the external bony wall is removed by means of the external operation, would seem to substantiate such a conclusion as to the pathology present.

Returning to the subject of sinusitis in children, a subject so close to our host of today. The removal of diseased tonsils and adenoids is imperative as a first consideration, since the beneficial effects are undisputed. Secondly, conservative treatment has been demonstrated to be successful. Dean reports success in 80 per cent of cases so treated. The insidious type of nonsuppurative closed infections presents many difficulties in private practice. The great difficulty lies in getting the patients. Localizing symptoms are masked, and only a small proportion of these little patients are under the care of pediatricians or men awake to the fact that a sinusitis may so exist and be the focus in causing general ill health. Publicity directed to the men in the general field of medicine is needed. And

the most encouraging part of our information to them is that the clinical procedures proposed will be along most conservative lines, in all but exceptional cases. It will be the conservative reestablishment of drainage.

CONCLUSIONS.

The nasal accessory sinuses are physiologic air chambers.

Their lining membranes are individualistic in their histology and pathology.

The prevalence of changes in the lining membrane, that may be termed pathologic, is very great, yet the individual may be enjoying perfect health.

Climate, mode of living and nutrition are factors to be considered, their proper correction markedly influencing pathologic tissue in this locality.

Drainage and aeration are the primary requisites in order that these air chambers may perform their physiologic function.

Conservative surgical drainage can have at least a symptomatic curative effect on many distinctly pathologic lining membranes.

The ablation of all pathologic tissue is not the first consideration, but rather the symptomatic relief with the least sacrifice of functionating tissue.

This is particularly applicable in private practice, where economic factors, residence and continued contact with patients are to be considered.

507 PUTNAM BLDG.

IX.

THE OLDER METHODS FOR TESTING HEARING.*

By George W. Mackenzie, M. D.,

Philadelphia.

The writer is prompted to present this paper for the reasons, first, that he feels it to be the duty of someone to appeal to the otologists at this time in behalf of the older methods of functional testing, not at all because of sentiment, but because of the unsurpassed value of these methods in the diagnosis of ear diseases; and secondly, because of the fact that some newer methods of functional testing, notably with audiometers, have recently been enjoying a popularity out of proportion to their real value to the neglect of the older methods.

The older methods for testing the hearing function, when carefully made and the findings properly interpreted, afford us more accurate information about otologic problems generally than any other diagnostic factor. In many cases the information obtained by these tests is more certain than that obtainable from the history and the otoscopic findings put together. For instance, in those cases of internal ear deafness due to the administration of such drugs as quinin and salicylates, where the history and the otoscopic findings point rather to catarrhal deafness, the tuning fork findings can be depended upon to establish the exact diagnosis.†

The history in the average case of deafness is not more than 75 per cent dependable, while the otoscopic findings are but

*Read before the thirty-second annual meeting of the American Laryngological, Rhinological and Otological Society, Montreal, Canada, June 1, 1926.

†The writer has in mind a case of a medical man who reported with the self-made diagnosis of recurrent attacks of acute middle ear catarrh, associated with deafness, following in the wake of every cold he had in the head. The functional tuning fork tests revealed a bilateral perceptive type of deafness. This led the writer to ask the patient what he was taking for his colds, and it was learned that he was taking a compound tablet containing cinchonin salicylate in large doses. The patient was advised to discontinue the drug and the deafness promptly cleared up.

a trifle more so. On the other hand, the functional hearing tests made on patients with normal understanding ought to approach 100 per cent dependability, *if*, and it is a big *IF*, the one making the tests knows his instruments and how to use them. It occasionally happens that patients presenting the otoscopic appearances of middle ear catarrh, including definitely retracted drumheads, suffer no impairment of hearing. Again, we not infrequently find cases in which the worse appearing ear otoscopically is the better one functionally. There is no sure way of telling from the otoscopic picture alone just how much impairment of hearing may be present in a given case. Besides, the otoscopic picture tells us nothing about the presence or absence of inner ear or nerve deafness. The diagnosis of these conditions is possible only by the functional hearing tests.

The most severe test to which we can submit a diagnostic method in otologic problems is in the detection of mixed forms of deafness—that is, obstructive deafness from a lesion in the middle ear combined with perceptive deafness from a lesion in the inner ear or nerve. The functional hearing tests with the tuning forks comprise the method for the solution of such problems, thanks to the long list of careful researchers in this field, including such men as Weber, Schwabach, Rinne, Bing, Politzer, Bezold, Hartmann, Alexander, Bárány and others less well known.

There is no case of aural disease in which the functional hearing tests are not a necessary aid in the diagnosis. The functional hearing test findings, elicited by painstaking efforts, tell us of the location of the lesion; whereas, just as painstaking efforts, directed along other channels, are required to tell us the character of the lesion.

In practically all diseases of the ear, external, middle and internal, including also the eighth nerve, there is one common symptom, and that is deafness. The amount of deafness is proportionate to the intensity of the pathologic process responsible for the deafness; while the character of the deafness is dependent upon the location of the lesion. The word character is used to differentiate deafness into (a) deafness associated with poor bone conduction, (b) deafness associated with good

bone conduction, which at times can be better even than normal air conduction, (c) deafness for the low tones with relatively good hearing for high tones, (d) deafness for low, middle and high tones, (e) total deafness for all tones. Deafness for high tones only, with preservation of normal hearing for low tones, may occur very exceptionally, but the writer has never found such a case.

Since the amount of hearing loss is dependent upon the intensity of the pathologic process rather than upon its location, the quantitative hearing tests can be of little value in determining the location of the lesion. On the other hand, since the character of the deafness tells us the location of the lesion, why not, in our effort to locate the lesion, devote our attention toward determining the character of the deafness, for instance, the quality of the Rinne and the Schwabach? It has been found repeatedly and by numerous investigators that in obstructive deafness, while the hearing is impaired for air conduction, it is actually improved for bone conduction. On the other hand, in perceptive deafness there is a decrease of hearing not only for air conduction but also for bone conduction.

Many explanations have been offered to show why the hearing for bone conduction is improved in the obstructive form of deafness. The most plausible is that which Prof. Gustav Alexander was in the habit of presenting in his lectures on "Functional Hearing Tests," twenty years ago and since. It is shown in illustration 1.

When a tuning fork is applied to the mastoid, the sound waves are conducted as follows:

1. Through the bone to the middle ear cavity, setting the ossicles and tympanic membrane in vibration, with the result that some sound waves find their way out of the external canal and are thereby lost. This fact can be demonstrated by linking up two individuals with an auscultating tube and applying the vibrating fork to the head of one when the sound of the fork is heard by the other. See illustration 2.

2. Through the bone to the middle ear cavity and out of the eustachian tube. Politzer made use of the opposite direction of conduction in the application of the test named after him.

3. Through the bone, the middle ear cavity, and the ossicles to the inner ear fluids—cranio-tympano-labyrinthine conduction.

4. Through the bone, directly to the inner ear fluids, without the intervention of the middle ear—cranio-labyrinthine conduction.

In view of these facts, it follows that in the presence of an obstruction in the external canal or eustachian tube, those sound waves which ordinarily escape by these routes are prevented from doing so. The volume of sound waves reaching the inner ear is, therefore, proportionately increased.

In the case of middle ear diseases producing impairment of hearing, the bone conduction is improved also, for the reason that any physical change in the middle ear which can act as an obstruction to the conduction of sound waves to the internal ear must act also as an obstruction to their escape by way of the external canal. See illustration 1. The question is occasionally put: In a case with total loss of the tympanic membrane, should not the escape of sound waves be favored rather than hindered thereby? The answer is no, and for the reason that the tympanic membrane, together with the ossicles, compose an amplifying apparatus which when impaired diminishes the amplification of sound waves outward as well as inward. Furthermore, in the case of obstructive deafness, the gain of hearing by bone conduction is about equal to the loss by air conduction. This gain is not confined to the side of the obstruction but is distributed over the two sides. Most of the gain is on the affected side. A less amount is contributed to the opposite (unaffected) side. There are several ways of demonstrating this cross conduction.

1. In the case of unilateral obstructive deafness, of even moderate degree, let us say of the right ear, the bone conduction is not only increased (lengthened) on the affected side, but also on the unaffected, left side. If the patient is alert he will, when the Schwabach is being taken on the left mastoid, refer the sound to the right ear, which is nothing less than a very strongly lateralized Weber to the right side.

2. In the case of unilateral perceptive deafness of moderate degree, let us say of the right side, the bone conduction on the right mastoid will be short, even shorter than it appears, for

the patient, if alert, will refer the sound to the left, in this case the better hearing side.

3. In the case of unilateral total deafness from a labyrinthine suppuration, extirpation of the labyrinth by operation, gunshot wound of the labyrinth, fracture of the skull involving the petrous bone from any cause capable of totally destroying the inner ear, the patient will appear to have a fair amount of hearing by bone conduction on the same side, something which cannot exist in fact. If the patient is intelligent and alert he will tell us that the sound is actually perceived by the opposite side. See illustration 4. Naturally, as one side borrows hearing from the other, there must be some loss of bone conduction on the contributing side.

Whenever we make a bone conduction test, whether it be on the mastoid or the midline or elsewhere on the skull, the hearing represents the sum total of the hearing function of the two ears and never of one ear alone. There is a more even contribution of hearing function from the two sides when the fork is applied to the midline than when applied anywhere else on the skull; and there is the most uneven contribution when the fork is applied to one of the mastoids. In no case is it possible to make a purely unilateral bone conduction test. We meet with a somewhat similar handicap when testing the semicircular canal apparatus by the turning tests. In neither case are we warranted in eliminating the test because of the apparent handicap of having two ears instead of one to reckon with. The real handicap is in not appreciating the fact that there are two ears to be considered; and in not knowing how to make proper allowances in interpreting the findings. The application of the tests and the proper interpretation of the findings belong to that most important phase of every subject: namely, technic. Functional testing is interesting only when it leads one to an accurate diagnosis, subsequently confirmed through other channels, the most valuable of which is the therapeutic test.

By a thoroughly accurate diagnosis in ear diseases is meant the determination (1) of the site of the lesion (qualitative diagnosis), (2) of the character of the lesion (pathologic diagnosis), (3) of the intensity of the changes or the degree of involvement (quantitative diagnosis), (4) of the primary

cause (etiologic diagnosis). While all four are necessary for a complete diagnosis, the most important is the first mentioned, since it is the primary object of every complete diagnosis. The fourth (etiologic diagnosis) is but a trifle less important than the first, while the second (pathologic diagnosis) is hardly less important than the other two, since in many instances it indicates the form of treatment best suited to the case. If compelled to decide which of the four diagnoses is of the least importance, one would have to say the third (quantitative diagnosis).

One of these diagnoses often helps us in determining the others. For instance, bilateral nerve deafness suggests a certain group of pathologic processes, while the unilateral suggests an entirely different group. Obstructive deafness suggests the presence of certain pathologic conditions in the nose, throat and nasopharynx. Further illustrations of how the diagnosis in one direction can help us in determining the diagnosis in another are to be found in the socalled constitutional diseases and the tendencies each has to produce its own definite form of ear disease: for instance, scarlatina and middle ear suppuration, epidemic cerebrospinal meningitis and bilateral nerve deafness, acquired syphilis and bilateral nerve deafness, hereditary syphilis and bilateral labyrinthine deafness, focal infection and unilateral labyrinthine deafness, diabetes and necrosis of the labyrinthine capsule, tuberculosis and caries of the temporal bone.

Before a thoroughly accurate diagnosis can be made in the average case it becomes necessary for the otologist to call to his aid specialists in other fields, including the neurologist, the ophthalmologist, the internist, the roentgenologist and the laboratory experts. However, it remains for the otologist to diagnose the location of the pathologic lesion or lesions present in and about the ear, something impossible without the aid of the functional hearing tests properly conducted. Properly conducted, in this case, is synonymous with accurate technic, and this means nothing less than elimination of errors while making the tests. Some of the ways in which it is possible for one to fall into error while making the functional fork tests are as follows:

1. Lack of knowledge of the pitch of the fork used for making the tests. For instance, the average weighted fork sold for a 256 DV actually vibrates about 190 DV, according to careful measurements made by Mr. Newell Parker, formerly of the Standard Scientific Instrument Co., of New York City. It is well for one to know the pitch of the fork he uses, otherwise, in reporting a case, for instance, in which a 256 DV fork was used, it will not have the same meaning to someone else who reads the report.

2. Lack of knowledge of the length of time the tuning fork one is using vibrates audibly for the normal hearing individual, both by air and by bone conduction. For instance, some forks can be heard to vibrate for as long as three minutes, while others of the same pitch can be heard for only a fraction of a minute. With the longer vibrating fork it is possible to obtain a plus Rinne of 80 seconds or more in the normal hearing individual; whereas, with the shorter duration fork it is possible to obtain a plus Rinne of only 20 seconds or less. A plus Rinne of 20 seconds, while it indicates the normal condition for the shorter vibrating fork, would indicate a pathologic condition with the longer vibrating fork. Professor Alexander's graph of the normal Rinne is impossible with any fork. See illustration 10.

3. Lack of attention to the position in which the fork is held while making the air conduction test. In other words, disregard of the nodal points or dead lines. A fork held in a faulty position—that is, at or near a nodal point—while taking the air conduction of the patient and then held in a more favorable position for the control will result in the finding of a greater impairment of hearing than actually exists. Furthermore, if the fork is held but slightly farther from the meatus of the patient than from that of the control, the patient will also appear to have a greater loss of hearing than actually exists, and vice versa.

4. Neglect of attention to the normal fatigue of the end organ that occurs when the tuning fork is held to the ear for a prolonged period without a rest. Besides, one should not fail to recognize the difference between normal and excessive fatigue.

5. Indifference to the manner in which the fork is applied to the mastoid when making the bone conduction test. For instance, if the fork is applied with pressure of one pound to the patient's mastoid and with a pressure of four pounds to the control's, the patient will appear to hear more poorly by bone conduction than he actually does. If the patient has a tender mastoid on one side the examiner is prone to apply the fork to that mastoid less firmly than he would otherwise. In this case the examiner should be careful to apply the fork just as lightly to his own mastoid in making comparative tests. Care should be taken in all cases to apply the fork with the same pressure to the patient's mastoid as to the control's.

6. Lack of knowledge as to whether the control hears normally or not. For instance, it happens every now and then that a beginner will find an unusually large number of cases of perceptive deafness present in certain general diseases, for instance, syphilis, which other careful examiners had failed to recognize before; when it is eventually discovered that the examiner himself was afflicted with obstructive deafness. His prolonged bone conduction makes every normal hearing individual appear to have a shortening of bone conduction.

7. Lack of attention to the age of the control as compared with that of the case under examination. For instance, it is not good technic to use a control 25 years of age or younger for a patient 70 years of age or older, since the normal difference in bone conduction is about 6 seconds in favor of the younger individual, with a fork that is normally heard for 70 seconds by bone conduction.

In the illustrations herewith presented the attempt has been made to show why there is an improvement in the bone conduction coincident with a reduction in the air conduction in socalled obstructive lesions. Next is shown graphically the approximate amount of improvement of bone conduction for the different degrees of unilateral and bilateral obstructive deafness, the amount of loss of bone conduction for the different degrees of unilateral and bilateral perceptive deafness, and the effects of borrowing and loaning of bone conduction in the case of obstructive deafness on one side associated with perceptive deafness on the other. Furthermore, illustrations

are presented showing the character of fork findings in mixed forms of deafness.

The variety of combinations of tuning fork findings by bone and by air is infinite. However, they are all reducible to one or another of the fundamental forms covered by the illustrations.

The explanatory notes under each illustration are sufficiently full so as to require no further reference to them in the text.

During the preparation of the skeleton of this paper the writer intended to reserve sufficient space near the close to point out some of the weaknesses of the arguments put forth by the advocates of the audiometers, but after a second thought decided rather to spend practically all of his available time in emphasizing the efficiency of the tuning fork methods.

It appears that no one yet has been able to diagnose the location of the lesion or lesions responsible for impairment of hearing by the use of the audiometer alone with anything like the consistency that is possible with the fork tests in the absence of an audiometer. The reason is not difficult to explain. With the audiometer, as presently constructed, it is impossible to eliminate bone conduction while making an air conduction test; furthermore, the bone conduction is bilateral, and, in view of the borrowing and loaning of bone conduction as pointed out in this paper, one can readily understand the difficulties the examiner must have in attempting to untangle the findings, the more so in unilateral cases and in the mixed form of deafness. Most of the audiograms presented in the literature are of bilateral cases of the same kind in which these handicaps are the least evident. Again, the higher the tones the farther the carrying power and the more easily cross conduction can take place. It was the knowledge of this fact that led Bezold to select the Edelman small "a_1" forks for the Stenger test.

The essential differences between the stand taken by the advocates of the audiometer and that taken by the advocates of the tuning fork methods are: first, that the former believe that they have developed an instrument of precision for testing quantitatively audition for different pitches and from these findings alone can plot an audiogram sufficiently characteristic to indicate the diagnosis; and second, that tuning forks are less accurate and therefore less reliable.

On the contrary, the advocates of the tuning fork methods contend that the most important object to be attained in the diagnosis is that of locating the lesion or lesions responsible for the deafness, and that this attainment is more possible with the aid of tests for comparison of bone and air conduction, making use especially of the Weber, Schwabach and Rinne tests, which are qualitative in character, than by quantitative tests with the audiometer. Quantitative tests with the continuous series of forks under the most ideal conditions have been attempted at different times by most careful researchers and always abandoned for the more certain qualitative methods.

1724 SPRUCE ST.

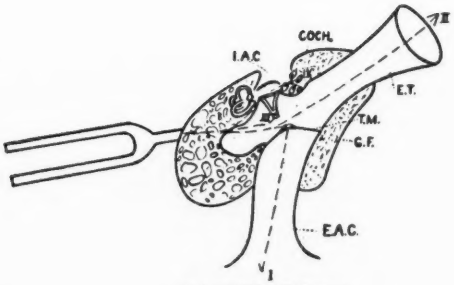


ILLUSTRATION 1

Illustration 1. Schematic representation of horizontal section of right temporal bone viewed from above with tuning fork applied to the mastoid. EAC indicates the external auditory canal; TM, tympanic membrane; GF, glenoid fossa; ET, Eustachian tube; COCH, cochlea; IAC, internal auditory canal; posterior to which are represented the semicircular canals.

The dashed lines (I, II, III, IV) represent the directions which sound waves take when the tip of the handle of a vibrating fork is applied to the mastoid. Line I represents the direction of escape of sound waves by way of the external canal which can be picked up with an auscultating tube and distinctly heard by some one else. (See illustration 2). Line II represents the direction of escape of sound waves by way of the Eustachian tube. Line III represents those sound waves which find their way to the inner ear through the medium of the tympanic cavity (cranio-tympano-labyrinthine conduction). Line IV represents those sound waves which find their way directly to the inner ear without the intervention of the middle ear (cranio-labyrinthine conduction).

It is plain to be seen that any obstruction along the course of the conductive apparatus—external canal, tympanic membrane, middle ear cavity—causing a reduction of hearing by air conduction must act also as an obstruction to the escape of sound waves and thereby improve the hearing by bone conduction in proportion to the degree of impairment by air conduction.

Illustration 2 shows the test to prove that sound waves produced in the skull of one individual by a vibrating tuning fork can be heard distinctly by another when the two are connected by an auscultating tube as shown in the photograph. The nurse is able to hear those sounds which ordinarily escape by the external canal.

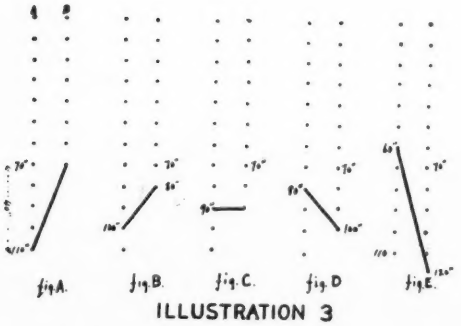


ILLUSTRATION 3

Illustration 3. Fig. A represents the normally positive Rinne and figs. B, C, D, and E represent the changes found as the result of increasing obstructive deafness, with a tuning fork that is normally heard by bone conduction for 70 seconds and by air conduction 110 seconds. The letter A just above the left hand top dot indicates air conduction while the letter B to the right of it indicates bone conduction. The spaces between the vertical row of dots indicate ten seconds of time, so that the twelve dots under the letter A indicates 11 spaces of 10 seconds each. The same applies to the dots and spaces below the letter B. The oblique heavy line in figure A represents the normally positive Rinne, in this case 40 seconds.

Fig. B represents obstructive deafness of the first degree; that is, a slight degree of impaired hearing by air conduction with a corresponding improvement (lengthening) of bone conduction. The Rinne is still positive but less positive than normal.

Fig. C represents obstructive deafness of the second degree in which there is more impairment of hearing by air conduction and correspondingly more improvement by bone conduction than in the previous case; so that, instead of there being a plus Rinne, it is plus-minus represented by the horizontal, full line.

Fig. D represents obstructive deafness of the third degree in which there is still greater impairment of hearing by air conduction and proportionate improvement by bone conduction, so that the Rinne has become minus or negative.

Fig. E represents obstructive deafness of the fourth degree in which there is found the maximum impairment of hearing by air conduction. (A greater impairment of hearing by air conduction in the case of pure obstructive deafness the writer can not recall). In this same case the bone conduction is increased to 120 seconds, which is more than the normal individual is able to hear by air conduction, something which on the surface appears to be impossible but is true nevertheless in rare cases.

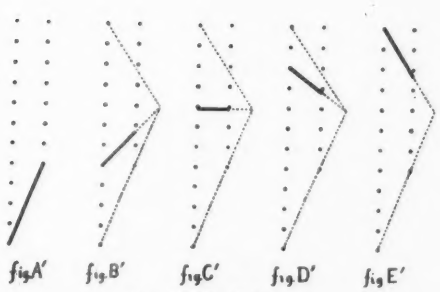


ILLUSTRATION 4

Illustration 4 represents the normally positive Rinne (Fig. A') and increasing degrees of perceptive deafness (Figs. B' to E' inclusive).

Fig. B' represents a unilateral perceptive deafness of the first degree in which we find shortening in both air and bone conduction. The Rinne is positive but less positive than normal.

Fig. C' represents unilateral perceptive deafness of the second degree in which we find more shortening in both air and bone conduction than in the previous case. The Rinne is plus-minus in that the air and bone conduction are equal.

Fig. D' represents a unilateral perceptive deafness of the third degree in which there is a still more pronounced impairment of hearing by both air and bone conduction than in the case of the second degree. Furthermore, the reduction of hearing for air conduction exceeds the reduction for bone conduction sufficiently to change the character of the Rinne, making it minus or negative.

Fig. E' represents the fourth degree of unilateral perceptive deafness (total deafness), in which the Rinne is even more negative than in unilateral perceptive deafness of the third degree. That any hearing should be found present by bone conduction on the mastoid of the affected side in the case of a total destruction of the inner ear would appear to be impossible. Nevertheless the fork is heard. However, an intelligent patient will refer the hearing to the other (intact) ear. Unfortunately, there is a large number of less intelligent patients who do not recognize the fact that they hear the fork from the other side. The average length of apparent bone conduction in the case of unilateral perceptive deafness with the hearing of the fellow ear normal is about 22 seconds, as is represented in Fig. E'.

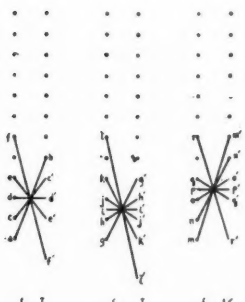


ILLUSTRATION 5

Illustration 5. Fig. I. The line a b represents the normally positive Rinne. The line c c′ represents the first stage of unilateral obstructive deafness; d d′ the second stage; e e′ the third stage; f f′ the fourth stage. The point through which all these lines cross is on the line representing the plus-minus Rinne, midway between the points d and d′.

Fig. J. The line g g′ represents the normally positive Rinne in the case where the fellow ear is affected with pronounced obstructive deafness. In the case of obstructive deafness the bone conduction is improved not only on the side of the obstruction but also on the opposite side, of course to a much less degree. For this reason the bone conduction represented by the point g′, Fig. J, is increased 10 seconds in spite of the fact that the air conduction is normal. This increase is due to borrowed bone conduction from the other side which is already affected with obstructive deafness. When the second ear becomes affected the bone conduction of this second ear will be better than in the case represented by Fig. I, in which the fellow ear is normal. In the case illustrated by Fig. J, all the lines representing the different degrees of obstructive deafness pass through the middle of the plus-minus line, drawn through the points i i′. The i i′ line in Fig. J is much lower than the d d′ line in Fig. I. In other words, where a patient is afflicted with bilateral obstructive deafness the bone condition is found to be better than in the case of unilateral obstructive deafness of the same degree and intensity.

Fig. K. The line m m′ represents the normally positive Rinne of one side in the case where the other is affected with pronounced perceptive deafness. In the case of perceptive deafness the bone conduction is impaired not only on the same side but also on the unaffected side; however, to a less degree. For this reason the bone conduction indicated by the point m′, Fig. K, is represented as being shortened 10 seconds in spite of the fact that the patient hears normally by air conduction. The Rinne represented by the line m m′ is 50 seconds positive instead of 40 seconds positive as indicated by line a b, Fig. I. The plus-minus line p p′ represents a greater shortening of hearing by air and bone conduction than in the case where the fellow ear is affected with obstructive deafness as in line i i′, Fig. J, or even where the other ear is normal as shown by line d d′, Fig. I. In the case where the other ear is affected with perceptive deafness the bone conduction for the different degrees of obstructive deafness is poorer than in the other cases. All the graphs will pass through the middle of the line p p′.

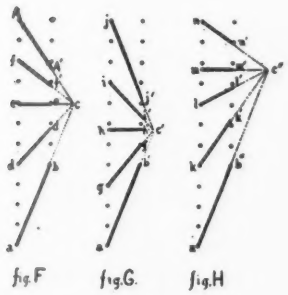


ILLUSTRATION 6

Illustration 6. Fig. F represents the changes that occur in the Rinne in the case of unilateral perceptive deafness with the fellow ear normal and corresponds to those found in illustration 3. The point c is found by continuing the solid line a b, representing the normally positive Rinne, to a point of intersection with a line drawn through A and A′ representing the negative Rinne of total unilateral loss of hearing. From this point c the remaining graphs for the different degrees of perceptive deafness are obtained as in illustration 3. For instance, d d′ represents first degree; e e′, second degree; f f′, third degree and A A′, fourth degree perceptive deafness.

Fig. G represents the changes that occur in the Rinne in the case of unilateral perceptive deafness associated with obstructive deafness of the fellow ear. In the case of the ear with obstructive deafness the bone conduction tends to be increased. Some of this increase is contributed to the side affected with perceptive deafness. The terminal stage, instead of showing a bone conduction of twenty-two seconds as shown in Fig. F will show a bone conduction of about thirty-seven seconds as shown in Fig. G. The intersection of lines a b′ and j j′ in Fig. G give us the point c′ from which the remaining graphs are obtained (g g′, h h′, i i′, j j′).

Fig. H represents the changes that occur in the Rinne in the case of bilateral perceptive deafness. In this case there is less bone conduction to borrow from the other side than in the case of obstructive deafness or in the case of normal hearing. Therefore, in the case of deafness of the side represented by Fig. H, with residual hearing on the other side, the end result would be represented by the line n n′. Where this line intersects the line a b″ is obtained the point c″ from which radiate lines that give us the graphs representing the different degrees of perceptive deafness when the fellow ear is affected by the same character of deafness (k k′, l l′, m m′, n n′).

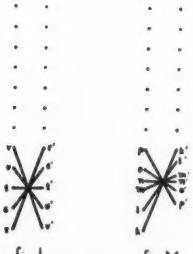


ILLUSTRATION 7

Illustration 7. The line r r′ in Fig. L shows the Rinne finding for the normal hearing individual, while the lines s s′ to v v′ show the Rinne findings for the different degrees of unilateral obstructive deafness if there were but one side to be reckoned with. However, since it is impossible to eliminate the fellow ear, borrowing and loaning from one side to the other must take place no matter on what part of the head the fork is placed, even though it be on the mastoid.

In Fig. M the line k k′ shows the Rinne findings for the normal hearing individual, while the lines l l′ to p p′ show the Rinne findings for the different degrees of unilateral obstructive deafness making allowance for an estimated contribution of one-third of the excessive bone conduction to the other side. Comparing the figures one can readily see that the increases in bone conduction in Fig. M are less than in Fig. L for the same amount of reduction in air conduction. The points r′ and k′ represent the normal bone conduction. The distances from r′ to s′, from s′ to t′, from t′ to u′, and from u′ to v′ represent ten seconds each, while the distances from k′ to l′, from l′ to m′, from m′ to o′ and from o′ to p′ represent about six and two-thirds seconds each, because one-third of the total increase (three and one-third seconds) is contributed to the other side. While in Fig. L is represented the forms of Rinne in unilateral obstructive deafness as they night be expected to occur theoretically, Fig. M represents them as they are found actually.

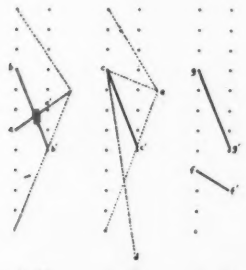


ILLUSTRATION 8

Illustration 8. Fig. N represents a case of mixed form of deafness. The solid line a a′ indicates a fair degree of perceptive deafness in which the air conduction is shortened 50 seconds and the bone conduction about 21 seconds. The Rinne is positive about 11 seconds. Subsequently the patient developed in addition obstructive deafness which shortened his hearing by air conduction 30 seconds more, while it increased his bone conduction 20 seconds. The net result is represented by the line b b′ in which the air conduction is represented as short 80 seconds while the bone conduction is short about 1 second. The Rinne is negative about 38 seconds.

Fig. O, let us suppose the line c c′ represents the findings at the time the patient presents himself (corresponding to the end result in Fig. I) and from which we are to make the diagnosis of the location of the lesion or lesions responsible for the impairment of hearing. The air conduction is short 80 seconds; the bone conduction is short about 1 second; and the Rinne is negative about 38 seconds. If the case were one of pure unilateral obstructive deafness with 80 seconds shortening in air conduction there should be a lengthening in bone conduction of about 53 seconds, represented by the point d. The line c d would therefore indicate a negative Rinne of 93 seconds. In view of these facts it is clear that the line c c′ could not represent a case of pure unilateral obstructive deafness. On the other hand, if it were one of pure perceptive deafness it would be indicated by the dotted line c e. Since the Rinne in this case, indicated by the full line c c′, corresponds neither to that of a pure obstructive deafness nor a pure perceptive deafness, but has taken on the character of both conditions, it must necessarily be one of a mixed form of deafness.

Fig. P represents another case of mixed form of deafness of one side in which the patient began with a pure obstructive deafness with 30 seconds shortening in air and 20 seconds lengthening of bone conduction with a negative Rinne of 10 seconds, indicated by the line f f′. At a later date he developed in addition a perceptive deafness causing a further reduction of 50 seconds, making a total shortening in air conduction of 80 seconds. At the same time there was a reduction in bone conduction of about 21 seconds, making the Rinne negative about 39 seconds, indicated by the line g g′.

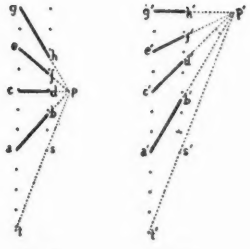


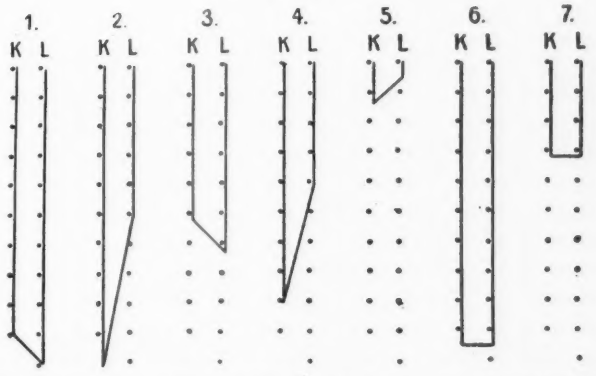
ILLUSTRATION 9

Illustration 9. Fig. Q represents the graphs of the several fork findings for the different degrees of unilateral perceptive deafness, already presented in figures B′, C′, D′, E′ in illustration 4. It is here presented alongside of figure R which represents the graphs for the same amount of deafness as in figure Q excepting that in the latter the fellow ear is already totally deaf. In the case of unilateral perceptive deafness with a normal fellow ear all the graphs will meet at the point p which is found by extending the line t s, which represents the normal Rinne, until it bisects the line g h, which represents the negative Rinne of unilateral total deafness.

In the case of progressive perceptive deafness of one side with total destruction of the fellow ear all the graphs will meet at the point p′ in figure R, which is found by extending the line t′ s′ until it bisects a line drawn through g′ h′, representing the end result of total bilateral perceptive deafness.

For the same amount of loss of air conduction in figures Q and R it will be found that the loss of bone conduction is greater in figure Q than in figure R for the reason that in the case represented by figure R there is no contribution of bone conduction from the fellow ear, whereas the amount is considerable in the case represented by figure Q.

Fig. 48.



Graphic representation of Rinné's test for clinico-diagnostic purposes. *K*, cranial conduction; *L*, air conduction.

ILLUSTRATION 10

Illustration 10 is a photographic reproduction of Fig. 48 taken from Prof. G. Alexander's excellent work on "Die Ohrenkrankheiten im Kindesalter" translated into English by Dr. Arthur Bedell.

The descriptions of the graphs read as follows:

1. In the normal ear, Rinne's test is positive with normal duration of perception through either cranial or air conduction (Fig. 48, 1).

2. In affections of the sound-conduction apparatus, Rinne's test is negative, with shortened air conduction and prolonged cranial conduction (Fig. 48, 2).

3. In affections of the sound-perceiving apparatus, Rinne's test is positive, with shortened cranial and shortened air conduction (Fig. 48, 3).

4. In affections of sound-conduction and sound-perceiving apparatus, the Rinne test is negative, with shortened cranial conduction (Fig. 48, 4).

5. In advanced stages of hearing insufficiency, the Rinne test is always negative (Fig. 48, 5), whether the affection involves the sound-perceiving or sound-conducting apparatus, or both. In the most advanced stages of progressive insufficiency, air conduction always diminishes more rapidly than cranial conduction. In very advanced cases, therefore, the Rinne test is of no diagnostic value.

The test is indifferent, undecided, or simultaneously positive and negative.

6. In light affections of the sound-conductors, in which there is a prolongation of the cranial conduction and a slighter shortening of the air conduction in such proportion that the same duration results from both ways of conduction (Fig. 48, 6).

7. In many advanced cases of middle-ear affections* (Fig. 48, 7).

The abbreviation L stands for Luft (air conduction), while the abbreviation K stands for Knochen (bone conduction).

These graphs are presented for the purpose of comparison with those offered by the writer. A casual glance at them might lead one to think that those presented by the writer and those presented by Prof. Alexander are

* The German reads "des Inneren Ohres" (of the inner ear).

alike, when in fact they are not, in spite of some points of similarity. For instance, if the spaces between the vertically running dots are equal to 10 seconds each as in the graphs presented by the writer then the length of air conduction in the normal Rinne, represented in graph 1, totals 100 seconds, while the length of bone conduction totals 90 seconds. The Rinne would then be plus 10 seconds. This is entirely too small an amount; in fact, there is no fork in existence that will give these figures.

Again, even if the spaces between the dots represent any other number of seconds than ten, Alexander's ratio between the normal air and the normal bone conduction is still as 10 to 9. The nearest approach to these figures could happen where the fellow ear is affected with pronounced obstructive deafness, when the lengthened bone conduction would make itself felt on the normal side, but never to such a marked degree. Moreover, no mention is made as to whether these graphs represent unilateral or bilateral affections, although this factor makes an appreciable difference in the findings.

Graph 2 is offered as a representation of a negative form of Rinne found in pure obstructive deafness. Here there is represented a shortening of 5 spaces of air conduction, while there is a lengthening of but 1 space of bone conduction. This again is impossible. If the graph is drawn to represent unilateral obstructive deafness, there should be a lengthening of bone conduction equal to approximately two-thirds of the shortening by air, whereas he represents the lengthening of bone conduction as one-fifth of the shortening by air. On the other hand, if it is drawn for a case of bilateral obstructive deafness, the bone should be lengthened still more than for a unilateral case. Graph 2 really represents a mixed form of deafness with the obstructive element predominating.

Graph 3 represents the Rinne of pure perceptive deafness. For a unilateral case of this kind it is accurate and its very accuracy makes the errors in graphs 1 and 2 stand out more plainly.

Graph 4 represents the Rinne of mixed perceptive and conductive deafness quite as well as it was intended by Alexander and bears out the writer's last remark concerning Fig. 2. Fig. 2 and Fig. 4 represent the same character of deafness in different degrees.

Graph 5 represents the advanced stage of hearing impairment in which, according to Alexander, the Rinne test is always negative, whether the affection involves the sound perceiving or sound conducting apparatus or both. In a measure this is true if the case is a unilateral one, but as to whether the case is unilateral or bilateral he does not say. However, the advanced stage of deafness which he represents in the graph never occurs from a disease of the conducting apparatus pure and simple, for when the hearing by air conduction is decreased more than 50 per cent. of the normal, there is present a complicating disease of the perceiving apparatus.

In the case of bilateral deafness from disease of the perceiving apparatus the Rinne is never found to be negative. It remains positive to the end. On the other hand, in the case of unilateral deafness as marked as that shown in graph 5 the Rinne ought to be even more negative than it is represented.

Graph 6 would be accurate if one could find a fork that would give a normal Rinne such as that presented in graph 1.

Graph 7 which represents the plus-minus Rinne of advanced disease of the inner ear (incorrectly translated into the English as "middle-ear affections") is only approximately correct, for if one takes the normal as Alexander presents it in graph 1 and extends a line to the left from the lowest points representing air and bone conduction and another line through the negative Rinne line of the far advanced deafness represented in graph 5 to ascertain the point of radiation of graph lines, he will find that the plus-minus line of perceptive deafness will pass horizontally through points in graph 7 two spaces below the level in which Alexander represents it.

X.

CEREBROSPINAL FISTULA FOLLOWING ETHMOIDECTOMY. RECOVERY.*

By Arthur M. Alden, A. M., M. D.,

St. Louis.

Mrs. C. L., age 40, weighing about 240 pounds, was seen first October 20, 1924, on account of pain in the right side of the head following an acute cold. The patient stated that four days previously she had contracted a severe cold, and since the day before I saw her had experienced very severe pain in and around the right eye. This pain was most intense at the right side of the root of the nose and radiated backwards over the right side of the head but did not involve the occiput or back of the neck. Patient had at time of examination a temperature of 100.6.

Examination revealed a nasal mucous membrane which was very red and turgescent. There was a marked superior deviation of the septum to the right, which compressed the right middle turbinate against the lateral wall of the nose. Under shrinkage, however, pus could be seen in the right middle meatus, under both the anterior and posterior ends of the middle turbinate. Median rhinoscopy was impossible, due to the configuration of the septum. The left side of the nose was clear, no pus being seen by either anterior or posterior rhinoscopy. The tonsils have been cleanly removed. The leucocyte count at this time was 11,500.

The patient was sent to bed with the usual treatment for an acute sinusitis, which consisted of a shrinking spray in the nose, saline purgation, cold applications to the affected area and salicylates by mouth. At the end of a week she was entirely recovered, the nose was clear and no pus was visible. She complained, however, that the headache behind the right

*From the Department of Otolaryngology, Washington University Medical School, St. Louis.

eye and at the root of the right side of the nose was still present.

From this time until January 22, 1925, the patient was seen at frequent intervals on account of the headache, of which she complained bitterly. This she localized always in the same spot, around and behind the right eye and in the right parietal region. At no time after the acute attack was pus again seen in the right side of the nose, although shrinkage, suction and posture were all used in an attempt to find it. Lavage of the right maxillary sinus was negative, and the right frontal could not be probed. Radiographs showed a cloudiness in the right ethmoid region, all other sinuses being clear.

January 23, 1925, under local anesthesia, a right middle turbinectomy was performed, following the technic described by Sluder. After the second cut pus flowed into the incision. When the anterior half of the turbinate and ethmoid wall were removed, a cavity was disclosed which apparently had been a closed empyema of the ethmoid bulla and contiguous cells. In the extreme medial superior part of this cavity a downward bulge was seen which, when touched with a probe, proved to be dura. No escape of cerebrospinal fluid was seen at this time. The edges of the incision were trimmed off and she was sent back to bed without the nose being packed.

The morning following the operation the patient felt well but stated that she had considerable secretion from the back of her nose into the throat. When she sat up in bed there was a drip of serosanguinous fluid from the side of the nose which had been operated upon. On again reclining upon her back she was conscious of the postnasal dripping into her throat. The following day this same phenomenon was observed, with the difference, however, that now the fluid was clear instead of being mixed with blood. A specimen was collected and sent to the laboratory and was reported as being cerebrospinal fluid.

With a view to dehydrating the patient, reducing intracranial pressure, and, if possible, stopping the flow of cerebrospinal fluid, she was given only hypertonic fluids, and even these in quantities sufficient only to satisfy her needs. In addition to this, mild daily saline catharsis was employed and urotropin, 7½ grains, three times a day, was given. She was not allowed to even raise her head from the bed for two weeks. During

this time a constant check was kept on her fluid intake and output. At no time during this period did she have any temperature, and the leucocyte count remained consistently below 9000. At the end of the first week of this period the patient said that she was no longer conscious of the drip of fluid into her throat. After another week she was allowed to sit up in bed. The fistula was apparently closed, for no fluid escaped from the nose or ran into the throat. The restrictions on the activities of the patient were now somewhat relaxed, the fluids were changed to normal and the amount of intake gradually increased each day until, at the end of two more weeks, she was out of bed and feeling well. The headaches had disappeared and she has been entirely well up to the present date. Examination of the nose now shows that the area where the dura was exposed is covered with smooth white scar tissue.

There are several points of interest in this case. First, the fact that following an acute sinusitis a closed empyema developed was probably due to the configuration of the right middle turbinate, which was so compressed against the lateral wall of the nose that it entirely obstructed all drainage from the anterior ethmoid group of cells into the hiatus semilunaris. This prevented the normal process of resolution following the acute attack, and although the patient developed a certain amount of immunity against the infection, as shown by the fact that the temperature and leucocytosis subsided, the process continued, with involvement not only of the mucosa but of the underlying bony structures as well.

Second, the fact that this patient weighed 240 pounds made the extreme dehydration necessary to reduce intracranial pressure enough to stop the flow of cerebrospinal fluid.

XI.

X-RAY INJURY TO THE LARYNX WITH REPORT OF A CASE.*

By Samuel Iglauer, M. D.,

Cincinnati.

Some twenty cases of severe injury to the larynx following exposure to the X-ray have been recorded in the literature in the past five years. All of these cases followed the use of deep roentgen therapy, applied either directly over the larynx or to some adjacent pathologic condition in the neck. All of the recorded cases occurred in continental Europe and are reported chiefly in the Austrian or German journals.

Strandberg's case, recorded in the Journal of Laryngology and Otology, is a translation from the Danish, and von Rossem's report in the same publication originated in Holland.

The absence of case reports in English speaking countries may, perhaps, be explained by the fact that modern deep X-ray therapy, with high voltage machines, was developed in Germany during and after the world war and is a comparatively recent innovation in England and America.

Marschik,[1] in Hajek's Festschrift, 1921, collected data on seven severe cases, four of which had come under his personal observation. Jüngling,[2] in 1923, reported on a thorough study of thirteen cases of carcinoma of the larynx which had been treated by deep X-ray in the clinic with which he was connected. He described three forms or degrees of X-ray injury to the larynx, and the classification which he adopted covers the subject very completely and is very useful.

1. The early reaction.

The early reaction appears within three days after radiation. The most marked swelling seems to occur in the subcutaneous fat and lymph glands and not in the mucous membrane.

*Read before the American Bronchoscopic Society in Montreal, May 29, 1926.

Marked edema does not occur. At first there is an increased salivation, which is soon followed by a feeling of dryness in the throat. Occasionally there is some hoarseness, which may last for several days.

2. THE TRUE ROENTGEN REACTION.

The true roentgen reaction appears in from ten to twenty days after radiation. The larynx reaction is characterized by a feeling of dryness in the throat, often accompanied by hoarseness. The secretion of the mucous glands is diminished. The larynx shows a moderate glassy edema, often associated with a membranous deposit in the mucosa. There is rarely so much swelling that respiration and deglutition are interfered with. However, in one case of Marschik's the swelling was so great that tracheotomy was necessary.

3. THE LATE REACTION.

The late reaction may occur at any time from four weeks to about one year after X-ray treatment. It may occur without the evidence of any previous reaction. Severe pain, marked aphonia associated with extreme dyspnea and dysphagia commonly occur. The subcutaneous tissues and the submucosa may become indurated. The muscles of the neck and larynx often undergo degeneration and disappear, to be replaced by fibrous tissue. The deeper tissues of the neck are frequently firmly matted together with the obliteration of all lines of cleavage.

According to Marschik, perichondritis and necrosis of the cartilage is the predominating lesion, to which he gives the name "perichondritis radiotherapeutica."

Report of Case.—Miss X, aged 26 years, came under my observation on February 1, 1926. Her chief complaints were severe pain in the throat and inability to swallow even liquids. This extreme dysphagia had been present for three days.

Previous history: In October, 1925, she noticed a swelling in the cervical lymph glands, one of which was removed, and the diagnosis of Hodgkins' disease was established. A roentgenogram of the chest showed that the mediastinal lymph glands were also involved. The patient was treated with an ordinary X-ray machine during the months of October, No-

vember and December, at weekly intervals, for about ten minutes at a time. Subsequently she received five deep X-ray treatments, one hour each, on alternate days, ending January 22, 1926; three applications to the neck and two to the chest (190 K. V., 5 M. A., 1 C A1, one hour at 50 cms.). After the course of X-ray treatment the enlarged cervical glands, as well as the mediastinal tumor disappeared. On January 23, she felt a scratchy sensation in her throat, with increasing pain on swallowing, which became so severe that she could not swallow water except with the greatest difficulty. On January 31, the patient ejected a piece of tissue from the mouth. She stated it was about three-quarters of an inch long, one-quarter of an inch wide and was of soft consistency and grayish color.

Present condition: The patient has severe pain in the hypopharynx and is unable to swallow. The skin of the neck is pigmented, unusually smooth and shows a furfuraceous scaling. There is a small scar behind the left sternocleidomastoid muscle at the site of removal of the gland. On forcing the cricoid cartilage toward the spinal column, the patient experiences pain in the larynx region. There is no external swelling of the larynx. Laryngoscopic examination shows the mucous membrane over the arytenoids to be somewhat swollen, especially on the posterior aspect, and on the posterior surface of the cricoid cartilage an ulcerating surface and membrane is seen in the hypopharynx. The ulcer was cocainized; the slough was removed and sent to the laboratory for examination. Orthoform powders were prescribed, and the patient was able to swallow liquids, and after three days could take soft foods. On February 6th the condition was much improved, but a slight ulceration was still present. By February 11th the ulceration had healed.

Report of the microscopic examination: The report of the microscopic examination of the specimen removed was as follows (Drs. A. Faller and M. Herzberg).

"The specimen of tissue of Miss X shows inflammatory and necrotic exudate consisting of fibrin, pus cells and blood; lying within the meshes are large degenerated squamous epithelial like cells of aberrant shape. These have no definite arrangement. Diagnosis: Slough of mucous membrane."

March 26, 1926. The Wassermann test was reported negative.

Comment: Considering the history of this case, as well as the local reaction and pathologic findings, the diagnosis of X-ray injury to the larynx is certainly warranted. The glandular disease itself could scarcely have produced the lesion, and there was nothing noted which might suggest diphtheria. The case belongs in the category of the true X-ray reaction in the larynx, although the loss of mucous membrane in the form of a slough approximates the group of the late reactions.

Pathology: The important pathologic changes which take place in the larynx and neck occur as a result of the late reaction and are best described by Hofmeister,[3] who, within a period of eleven months, encountered three fatal cases of X-ray injury to the larynx. (Incidentally these are among the fatal cases reported by Jüngling.) The symptoms in two cases were so severe that both tracheotomy and gastrostomy were required to alleviate the suffering of the patients. Postmortem examination showed ulceration of the laryngeal mucous membrane, perichondritis and necrosis of the cartilage, together with degeneration and fibrosis of the extrinsic laryngeal muscles. The overlying skin was intact, but the vitality of the subcutaneous structures of the neck had been so impaired that gangrene had occurred after operation. There was no thrombosis in the larger vessels of the neck, which, however, "were held open as if fixed in celloidin."

Prognosis: Marschik, Jüngling and Hofmeister[3] together reported or collected twenty cases with severe reaction. Of these, five died either as a result of pulmonary complications or septic infection. Marschik was compelled to perform a tracheotomy in three of his four cases, and in one of these he subsequently performed a laryngectomy. Death ensued in two of his cases. Hofmeister's three patients all died, two after tracheotomy and one after laryngectomy.

In addition to the twenty cases mentioned above, I have found seven other cases recorded in the literature, namely, those of Mühlmann,[4] Feuchtinger,[6] Koenig,[7] van Rossem,[8] Strandberg[9] and two of Thost.[5] (One of Thost's cases died and one recovered.) (Tonndorf's case does not belong in the category of severe reactions.) Of these seven cases four re-

covered and three died, either as a result of the injury or from complications. Thus, out of a total of twenty-seven cases, exclusive of my own, thirteen, or 48.1 per cent, proved fatal. This exceedingly high mortality cannot be attributed to disease of the larynx itself, because in many of these cases the larynx was not diseased when the X-ray therapy was instituted.

Marschik stated that when perichondritis and necrosis occurred the result was universally fatal, but this has not been entirely borne out by subsequent observations, since the severe cases of Strandberg and Koenig both recovered despite the occurrence of sequestration of the thyroid cartilage.

Dosage: Many of the cases recorded (as well as my own) undoubtedly received an excessive or cumulative dosage of X-ray, but this does not appear to have been the rule in all cases. The radiosensitivity of cartilage may perhaps be explained by the absence of blood vessels in chondrial tissues. It is also fair to assume that some larynges are more radiosensitive than others. Schroeder[11] protests that roentgen therapy is practically harmless if properly applied, and quotes Peyser's statement "that tuberculous glands should be treated by X-ray and not operated upon." Beck and Rapp[12] insist that X-ray treatment of the larynx should not be discarded but that the so-called full "carcinoma dose" should not be applied over the larynx. They add that papillomata and tuberculous glands require relatively small doses.

Treatment: The milder cases of roentgen ray damage to the larynx require only palliative treatment. In the late reaction with sequestration of cartilage the necrosed cartilage should be removed. Frequently tracheotomy will be necessary to prevent asphyxia, while gastrostomy may be required to relieve the dysphagia. Laryngectomy has been performed in several cases with uniformly fatal results.

Conclusion: From what has preceded it is apparent that there is a potential and serious danger to the larynx in therapeutic irradiation of the neck, and that every precaution should be taken to protect the larynx from excessive or cumulative dosage. In the X-ray treatment of the neck the larynx should be protected, as far as possible, by lead foil. When the larynx itself is diseased the rays must be applied directly. Under

these conditions, even with proper precautions, an occasional case of severe injury to the larynx will be encountered. Owing to the profound tissue changes which occur after irradiation which invite gangrene, no operable case of carcinoma of the larynx should be subjected to X-ray treatment.

701 Race St.

BIBLIOGRAPHY.

1. Marschik, N.: Roentgenschädigung des Kehlkopfes. Supplement to Monatsschr. für Ohrenheilk. Vol. 55, pp. 1445-1460, 1921.
2. Jüngling, O.: Über Roentgenspatchädigungen des Kehlkopfes, Vorschläge zu deren Verhütung. Strahlentherapie, Vol. 15, pages 18-47, 1923.
3. Hofmeister, F.: Über tödlich verlaufende Roentgenschädigungen des Kehlkopfes. Münch. med Wochenschr., Vol. 69, page 1687, December 8, 1922.
4. Mühlmann, L.: Beiträge zur Roentgenschädigung tiefliegender Gewebe. Strahlentherapie, Vol. 15, page 52, 1923.
5. Thost, A.: Handbuch der Hals-Nasen-Ohrenheilkunde. Zweiter Band, 1926, page 322.
6. Feuchtinger, R.: Fall von Roentgenschädigung des Larynx. Monatsschrift für Ohrenheilk., Vol. 66, page 865, 1922.
7. König, E.: Zur Kaptel der Roentgenschädigung nach Halsenstrahlung. Münch. med. Wochenschr., 70, page 558.
8. van Rossem, A.: Injury to Larynx Induced by X-ray Treatment. Jour. of Laryn. and Otol., Vol. XXXVIII, No. 9, Sept., 1923.
9. Strandberg, O.: Injury to the Larynx Induced by X-ray Treatment. Jour. of Laryn. and Otol., No. 8, Vol. 39, pages 437-440.
10. Tonndorf, W.: Roentgenschädigung des Kehlkopfes. Zeitschr. für Hals-Nasen und Ohrenheilkunde, XIII, pages 22-26, 1925.
11. Schroeder, A.: Zur Gefährlichkeit der Roentgenbestrahlungen der Halse. Münch. med. Wochenschr., 70, page 849, June 29, 1923.
12. Beck, K., and Rapp, H.: Zur Frage der Roentgenschädigung des Kehlkopfes. Münch. med. Wochenschr., 70, page 848, June 27, 1923.

DISCUSSION.

Dr. S. Yankauer, New York: These cases are extremely interesting. We should all be interested in hearing of these accidents. In the cases reported by Dr. Iglauer, the fact that the larynx was damaged through radiation became evident through the changes that occurred there. Changes may occur in the larynx which give no intense reaction, but still there is some. What occurs is the production of an endarteritis which devitalizes the tissues which have been radiated. In one case of recurrent carcinoma of the larynx radiation was done. There was no fibrosis after laryngectomy. Then the patient developed a chill and died four days after the operation. At

the postmortem there was found to be an intense sloughing of the tissues of the neck. They were burned black. In another case a laryngectomy was done for incipient carcinoma of the larynx. Operation was one month after the first appearance of the growth. There was then no difficulty for six years; then there was recurrence of the growth. Treatment by radium and deep X-ray therapy was done, with no result on the recurrent carcinoma, but so much thickening of the larynx that we decided to do tracheotomy. The operation acted like touching tinder with a lighted match. Necrosis of the larynx occurred, and piece after piece was removed until the entire larynx was gone, and the patient was fed through an esophageal tube. Finally the carcinoma and the larynx were extruded. The patient weakened and died of inanition. The operation started the trouble. Immediately after operation the sloughing began. Never operate on a larynx which has been treated with radium. Patients come to us from other physicians after radiation treatment, the amount of which we do not know.

Dr. L. H. Clerf, Philadelphia: There have come to the Bronchoscopic Clinic several patients, all children, who before admission had been treated with radium for papillomata of the larynx. In every case the patient wore a tracheotomy cannula because of inability to breathe through the normal passages. Subsequent investigation revealed that the larynx in every case had been practically completely destroyed, being replaced by a mass of fibrous tissue. In one case the papillomata continued to recur both above and below the obliterated airways. There certainly seems to be little justification for the indiscriminate use of such powerful agents which, after all, seem to be of questionable value in laryngeal papillomata and are capable of doing irreparable damage.

Dr. Lafayette Page, Indianapolis: I think it is the opinion of leading pathologists that radiation which is sufficiently powerful to affect the carcinoma will start up perichondritis and sloughing of the cartilage. My experience is that this view is correct. In two cases of early carcinoma of the larynx I have advised thyrotomy. One patient had been treated three months by radiation and one six months. They had had deep X-ray treatment. They came back later and I did a hemi-

laryngectomy. I found the cartilages in such a condition that recurrence would take place. It did very quickly. Any dosage sufficient to affect the growth is a dangerous thing to use in the larynx. The best pathologists hold this view, and I have found that these cases are inoperable after this type of treatment.

DR. E. G. GILL, Roanoke, Va.: I had a case two years ago of papilloma of the larynx. I did a tracheotomy in this case. The child had had two applications of deep X-ray radiation. I think diathermy had been done. I did a tracheotomy and the child wore a tube eight months. Then we removed the tube. The child has no further trouble, as far as breathing is concerned, but has no voice. I do not know whether this is due to the X-ray treatment or to the manipulation.

DR. WM. B. CHAMBERLIN: Dr. Hubbard is able to write with only one finger on the typewriter, after his stroke, but he writes enthusiastically of his work on papillomata of the larynx and the results he has obtained by fulguration.

DR. D. CROSBY GREENE, Boston: I would like to report a case of recurrent carcinoma of the larynx following a rather extensive thyrotomy operation a year ago.

The patient was subjected to intensive irradiation by radium emanations and high voltage X-ray systematically after operation. The X-ray man felt that the case had received about all the radiation it was safe to give. There was marked pigmentation and induration of the neck in the region of the larynx, but a progressive recurrenec of the growth was taking place. This patient was recently operated upon by diathermy. The entire area involved was first thoroughly desiccated and then, by the cutting current, excision of the whole mass was done. This left a large cavity in the neck above the tracheotomic opening, full 4 cm. in diameter and 2 cm. deep. This was left open and packed. The healing of the wound in this case took place with very little inflammatory reaction, and the cavity became rapidly lined with healthy granulations. We do not expect that the case has been cured. It is too early to suggest that. But enough has been accomplished to suggest that a field of usefulness for diathermy in this type of case may be found.

DR. IGLAUER (closing): The experience which Dr. Yankauer has had agrees with the usual reports in regard to tissue

sloughing. The skin may be all right, but operation often causes the deeper tissues to slough out. As a result of the X-ray there is an endarteritis in the smaller vessels with interferes with the nutrition of the tissues and probably also with the nutrition of the tumor when one obtains results. I think the effect of radium is the same as that of the X-ray. In regard to the use of diathermy, it might prevent the spread of infection. One reason I presented this paper was to see how many cases had occurred, because they have not been reported. I thought it was important to bring this to the attention of the laryngologists to serve as a warning as to the dangers of deep X-ray therapy.

XII.

THE ADVANTAGES AND DISADVANTAGES OF THE PROXIMALLY ILLUMINATED BRONCHOSCOPE.

By Sidney Yankauer, M. D.,

New York.

When the history of the present era of laryngology will be written, the name of Gustav Killian will stand out as one of the foremost, not only because of his originality of thought, but also because of the clever mechanical applications which brought his ideas to successful fruition. Probably the most revolutionary of his works was the invention and practical clinical application of bronchoscopy. Shortly after his first demonstration, bronchoscopy was taken up in this country. It received an impetus when Fletcher Ingalls demonstrated the simplicity and ease with which the bronchoscope could be illuminated by inserting a small electric lamp into its interior, but it was not until after the mechanical perfection of the distally illuminated bronchoscope by the honored founder of this Association, that Chevalier Jackson, through his inimitable art, consummate skill and unsurpassed aptness for instructing his colleagues in this specialty, and the general medical profession as well, succeeded in making bronchoscopy possible, not only for those with exceptional skill, but for all who possessed average technical ability. Bronchoscopes illuminated by this method are now so generally used in this country that to many, especially the younger men, the original procedure of Killian is hardly known, or is known only as a relic of a past era. There is no doubt that distal illumination is mechanically simpler, that the apparatus is less complicated and less difficult to keep in order. Furthermore, the instruments have become standardized and replacement parts can be purchased in almost any drug store. The illumination of the distally illuminated bronchoscope is most intense at the end of the bronchoscope. For this reason it is particularly well adapted for foreign body work, and as Jackson has concentrated his attention almost entirely upon this branch of bron-

choscopy, the rapid popularity of the distally illuminated instruments is readily understood.

The situation has been somewhat different with the writer, for, working as he does in a large general hospital, his attention was called, at an early stage in the development of bronchoscopy, to its value in the diagnosis and treatment of diseases of the organs of the chest. The number of diagnostic and therapeutic bronchoscopies increased much more rapidly than did the foreign body work, until today at Mt. Sinai Hospital, in New York City, the cases referred for diagnosis and treatment are fully ten times as many as the cases admitted for foreign body removal, so that foreign body work is but a minor portion of the work of the bronchoscopic department. The writer has used both distal and proximal illumination, but has invariably returned to the proximally illuminated instruments. I have developed a technic which has become routine, and, to make clear what I mean by proximal illumination, it is necessary to outline my technic. In Europe, several different types of proximally illuminated instruments have been devised, with all of which I have experimented. I have discarded all extensible tubes, as I have found them impractical and unnecessary. I use only single straight tubes of circular cross section. Three diameters, one for children, and one for infants, and two lengths, one long enough to reach the bottom of the bronchus and a shorter one for tracheoscopy are needed. It is only in exceptional cases that different lengths or sizes may be required. Two sources of proximal illumination must be used—one unit consisting of a lamp, a lens and a mirror movably attached to the bronchoscopic tube. It is convenient for introduction, examination and demonstration. A second similarly constructed unit is attached to the operator's forehead and used for all operative manipulations. Both sources of illumination are desirable, but if either must be dispensed with, it is the illuminated handle which can be more easily spared. The headlight is somewhat more difficult to manipulate, and it is this which has created the greatest difficulties for proximal illumination. I do not believe that even so gifted a man as Jackson would have succeeded in popularizing bronchoscopy if he had been limited to this single method of illumination. The difficulties in the use of the headlight

are of two kinds: first, the instrument must be correctly constructed, so that it can be easily adjusted to the head of the operator. The instruments are not at present manufactured in this country; repairs and replacements are not easily obtainable. In fact, the bronchoscopist using this method of illumination must possess some mechanical ability, but we have Jackson's word for it, that those who wish to succeed with the distally illuminated instrument must also be good mechanics. The second difficulty arises from the need for practice and experience in manipulating the headlight. The best method of overcoming these difficulties is to use the headlight for all kinds of examinations and operative procedures on the nose and larynx. The skill acquired in this way serves well during bronchoscopy. Once these difficulties have been mastered, the operator is no longer conscious of the fact that he is wearing a headlight, but finds that every place he looks at is always illuminated. The light is a very powerful one, and the illumination is unsurpassed by any form of headlight. To my mind, the illumination, even at the bottom of the longest esophagoscope, is fully as good as with distal illumination.

Proximal illumination has one advantage which has made it for me the method of preference; that is, whereas with distal illumination only the parts immediately adjacent to the end of the bronchoscope are visible, with proximal illumination all of the bronchial tree which is axially presented—i. e., which is in a line with the bronchoscope—is illuminated to its most distant point. As soon as the vocal cords are passed, the bifurcation is usually visible, sometimes even before the cords are passed; not infrequently, the entire right bronchus, down to the bottom of the axially presented secondary and tertiary branches, are illuminated and visible when the end of the bronchoscope has reached the middle of the trachea. The picture of the bronchial tree is not conceived as the combination of a series of individual pictures, but is seen as a whole. Relations of the various parts to each other are easily perceived, the color of the mucous membrane of the various parts is easily compared, the relative motion due to respiration or to the heartbeat can be estimated, the location of each branch can be quickly determined and the distortions, displacements and deformations of the walls of the bronchial tree can be readily recog-

nized. Of special importance is the fact that the lesion, whatever it may be, can be seen long before the bronchoscope is actually down upon it, and disturbance or obliteration of the lesion by the pressure of the tube can be avoided.

Of secondary importance is the fact that the lumen of the bronchoscope is relatively larger and the external diameter relatively smaller than the distally illuminated instruments, because of the absence of the light carrier and the light carrying channel. The advantages of these slight differences may be disputed by the users of the distally illuminated instruments, but I could never agree with the statement made by them that the length of the bronchoscope was immaterial. I could always easily estimate differences in axial distances along the line of vision by the effort at accommodation needed to focus the eye at a given point, and my vision has always been keen enough to appreciate small differences in axial distances. The more uniform illumination given by the reflected light from proximal lamp seems to me to be helpful, while the more localized light of the distal lamp, fading into complete darkness in the deeper parts, seems to be more confusing in this respect. In like manner, the obliquity of the shadows caused by the distal lamp has never appealed to me as having great importance, but now, since with beginning presbyopia, I find the need of wearing glasses, it may be that in the future I will change my mind. As most doctors wear glasses, and as glasses unquestionably interfere with the acuity of vision by shortening the length of the perceivable focus, I realize that the majority may differ with me on this point.

An advantage of the tube with a clear circular outline, which has of late become more important to me, is the ability to use certain accessory instruments; for instance, I have one instrument which I call the bronchus searcher—it is a half open tube with a curved and somewhat pointed end. With this instrument I can enter the opening of a branch bronchus which lies at right angles to the axis of the bronchoscope, and by rotating the instrument can bring this bronchus into axial presentation and inspect its lumen. The difficulty of getting into the upper lobe branches, which is sometimes met with, is completely overcome. It is equally as easy to introduce the searcher into

either upwardly or downwardly directed branches and to pick out tertiary branches for separate inspection. With this instrument, it is also possible to dilate a bronchus normally of small diameter, until it is large enough to allow the entire searcher to enter. In cases of lung abscess, for instance, I have been able to follow up the pus into branches of the third and fourth order, dilating them as I proceed, until the abscess cavity itself has been entered. I have not found it possible to use this instrument with distal illumination, not only because the lumen of the distally illuminated bronchoscope, on account of the light carrying channel, prevents the rotation of the instrument, a difficulty which is not insurmountable, but because with the distally illuminated instrument, the branch bronchus picked up by the searcher will not be illuminated at all, on account of the oblique direction of the light rays.

I must leave for the future a detailed account of the bronchoscopic symptomatology, as I see it, and will content myself now with describing a single case which illustrates one of the advantages of proximal illumination. The patient was a young man who for three years had had symptoms of a lung abscess, complete even to the clubbed fingers. The internist considered a foreign body excluded by the absence of an X-ray shadow and by absolute denial of the patient when minutely questioned in this respect. The case differed from the ordinary lung abscess only in the fact that there were frequent mild hemoptyses; although hemoptyses occur occasionally in lung abscess, they are not frequent and are apt to be more severe than in this case. He was referred to the bronchoscopic department for diagnosis. He happened to be one of those individuals in whom the right bronchus is in direct line with the trachea, so that as soon as the bronchoscope had passed the vocal cords it was possible to see down to the bottom of the right bronchus, and I was able to distinctly recognize the presence of a foreign body embedded in a mass of granulation tissue in the mouth of one of the lower divisions of the right bronchus. If I had been using a distally illuminated bronchoscope I would not have been able to see the lesion at all at this stage of the introduction. I had just announced my finding when the patient began to cough, as patients frequently do when the vocal cords are passed. He had a violent fit of

coughing and expectorated considerable pus. When the coughing ceased, the appearance which I had interpreted as a foreign body was no longer present. The bronchoscope was advanced up to the lesion, the granulation tissue was excised and the bronchus below it carefully inspected without seeing the foreign body. The entire bronchial tree was thoroughly searched, but no foreign body was seen. When the bronchoscope was withdrawn, my assistants began to search the masses of mucus and pus which were adhering to my operating gown and in one of these masses they found a piece of a shell of a nut which corresponded in every way with what I had seen in the bronchus and diagnosed as a foreign body. Now everybody who has had experience in the treatment of lung abscess has been able to report one or more cases of fully developed lung abscess which were cured in a most brilliant fashion by a single bronchoscopy, and these cases are emphasized with commendable pride. This case made a similar rapid recovery, as foreign body cases do when the foreign body is removed. Had I been using a distally illuminated bronchoscope I would not have seen the foreign body before it was coughed out, and the case would have gone on record as a case of lung abscess associated with a granuloma and practically cured in one bronchoscopy by the removal of the granuloma. It has previously been suggested, upon purely theoretic grounds, that these brilliant cures were in fact due to the expectoration of a foreign body during the bronchoscopy, but this was only a theoretic suggestion. Now that I have actually had the experience of seeing the thing happen, it makes it seem much more probable to me that this has happened in other cases. It suggests the desirability of collecting and examining all material expectorated by a lung abscess case, at least during the first bronchoscopy.

In conclusion, I am convinced that the greatest usefulness of the bronchoscope to by far the largest number of patients is the diagnosis and treatment of intrathoracic diseases, and for this purpose I am convinced that proximal illumination is the method of choice. It is true that distal illumination is easier for the operator, but proximal illumination, in spite of the additional trouble involved, will make a better diagnosis possible for the patient. Whether it is worth while for the doc-

tor to go to this additional trouble in order to confer a modicum of benefit upon the patient is a matter which every doctor must decide for himself.

DISCUSSION.

Dr. Wm. B. Chamberlin, Cleveland: Due to the enthusiasm of Dr. Jackson, it would seem that the proximally lighted scope, introduced by Killian, has fallen into disuse. The point which Dr. Yankauer has mentioned seems to me to be a very important one. I have tested out the use of the two scopes side by side, not only in the patient, but in the phantom as well, and the advantage of the proximally lighted scope over the distally lighted scope in illumination is very evident. If you place the scope in a rubber tube you have no view of the foreign body at all with the distal light until you are almost in contact with the foreign body; whereas, with the proximal light you will sight the foreign body just as soon as the scope has been introduced into the tube. There is no question about it. I have tried it out in the living subject and in the mannikin as well. In my early work I used the proximal light, but then later fell into the habit of using the distal light of Jackson.

Dr. P. P. Vinson, Rochester, Minn.: We have been using the proximally illuminated scope almost entirely. There are two points which it is worth while to emphasize. I do not think Dr. Yankauer mentioned them. His statement about the extension tubes in the bronchus is correct, but in the esophagus we prefer to have the extension tube, for the reason that the lesions or foreign bodies may be located at any point from the introitus to the cardia. If examination is begun with the long tube extending to the stomach the operator works with a handicap, using long forceps and working at a distance. The extension tube can be regulated from the end of the tube, and it is easier to work with short tubes and forceps than with long tubes and long forceps. A foreign body at the introitus is less easy to handle with the long than with the short tube. In regard to lighting with mirrors, with the running esophagoscopes and bronchoscopes we must be careful that these mirrors are uniform in the instruments purchased. An inferior mirror will dis-

perse the light and will not reflect it in parallel rays. I was interested to hear that New York men think the Yankauer headlight will do things that others will not do. That is, it will cast parallel rays as far as needed. Not all mirrors will do that. Dr. Sheard, our physicist, is working on a mirror that will cast parallel rays through the tube so as not to lose any of the rays.

Dr. Richmond McKinney, Memphis, Tenn.: Several years ago I read a paper before the Section on Otolaryngology of the American Medical Association, in which I made a comparison of the distally illuminated instruments, such as Jackson's, and the proximally illuminated instruments, as exemplified in Bruenings', to the disadvantage of the former. I was but a beginner in peroral endoscopy at that time, and presume my undertaking to discuss the merits of the two types of instruments was a case of "fools rush in where angels fear to tread." Maturer experience caused me ultimately to use preferably distally illuminated instruments in bronchial work, but I still frequently use the proximally illuminated instruments in esophagoscopy. There should be no difficulty in keeping the field ahead of the Jackson scopes clear by suction and swabbing, so the question of adequate illumination with these instruments does not, in my experience, figure to any large extent. The Bruenings instruments do give a wider lumen and a very bright light, and in the esophagus, where we are dealing with a soft, collapsible tube, doubtless this type of instrument has some advantage, but for tracheal or bronchial work, where there is a rigid and patent tube, I have found that the Jackson instruments can be handled with greater facility, and the cumbersome reflector handle, such as is required for the Bruening instruments, is not in the way to interfere with the facile manipulation of instruments.

Dr. W. L. Simpson, Memphis: For the larger bronchi or for the esophagus, either light works very nicely, but in very small children, when a 4 mm. tube is used, I do not think that any proximal light works satisfactorily. It is impossible to use a proximal light on such a small tube working on children.

Dr. M. C. Myerson, Brooklyn: Until two years ago I never had a proximally lighted instrument in my hands, and then I

became associated with an institution which uses that type of instrument. I feel that the proximally lighted tube has proven to be of great advantage to me, because I can see the field better and I can see a larger field. It is very much better in conditions of a diffuse nature. Further, one can use a larger tube. I think it is in just the type of case that Dr. Simpson mentioned that I would prefer to use the Bruening tube. I use the Bruening tube for diagnostic purposes, but for local manipulation I use the Jackson tube because of difficulty in using the headlight. That is the stumbling block. The introduction through the vocal cords is fairly easy, but it is difficult to focus the light from the forehead through the tube. I have passed a Jackson light carrier through the Bruening tube for the removal of a specimen.

Dr. McKinney: Would you use a 5 mm. tube on a six-months-old baby?

Dr. Myerson: Yes, I think a 5 mm. tube is the smallest tube available.

Dr. W. B. Chamberlin: If you have worked through a Jackson 4 mm. scope you must have encountered considerable difficulty. I think that Dr. Myerson has emphasized this point, which would oppose the point that Dr. Simpson made. The Bruening tube has an advantage in the smaller cases because it occupies less of the lumen of the bronchus than the Jackson tube. You can use the 5 mm. Killian scope in such cases where only a 4 mm. Jackson tube can be used.

Dr. H. H. Forbes, New York: In regard to proximal and distal illumination, I have been teaching students a number of years by the presentation of both instruments, starting my work with the proximal instrument, but, as my course developed, I came to the conclusion that, with beginners, they learned to handle their instruments better if they were taught with the distal first. Personally I prefer the distal illumination.

Dr. L. H. Clerf, Philadelphia: I have always believed that the difficulties in obtaining proper illumination would be insurmountable when one is using a proximally illuminated bronchoscope of proper size for removal of a bronchial foreign body in a small child. When forceps are introduced into the tube, is not the result the same as looking for something in

one's shadow? In foreign body work all manipulations and the application of forceps are best done within a short distance of the tube mouth. This is well within the brightly illuminated area furnished by a distally lighted tube.

Dr. Ellen Patterson, Pittsburgh, Pa.: Those who use proximal light advise tracheotomy in children under two years of age, and some go so far as to maintain that tracheotomy has to be done afterwards anyway. This has not been my experience with distally lighted instruments. I reported a case in the Archives of Otolaryngology, May, 1925, of bronchoscopy for the removal of a rabbit bone from the right bronchus of a two-month-old baby. I also reported a case of diagnostic bronchoscopy in a child four months old, and neither case required tracheotomy. If I were compelled to use proximal light, my conscience would not allow me to do bronchoscopy on a baby.

Dr. S. Yankauer, New York (closing): In regard to the technical part of the work—the use of a proximally illuminated bronchoscope which would be employed in a given case, compared with a distally illuminated instrument for the same case—the proximal is smaller internally and larger externally, on account of the absence of the light carrying attachment. In the 4 mm. tube the light carrying channel is over 3 mm. There is no difficulty in illuminating a tube of 5 mm. external diameter. It can be passed into a little child. In the case of a tracheobronchial diverticulum, I cleared out the membrane through that tube. I have mentioned in the paper that the illumination with the distally illuminated instrument is in every instance close to the end of the bronchoscope, so that for all work located at the end of the bronchoscope the distal illumination is more than desirable, and it is efficient. It would be absurd to attempt to dispute the efficiency of distal illumination for work situated at the end of the tube, but the point of my paper was that the main work of bronchoscopy is in the diagnosis of thoracic diseases. You can do many bronchoscopies if you educate internists to let you make diagnoses for them in obscure thoracic conditions. You can see thus many things that you cannot see with distal illumination, because of the comprehensive view of the bronchi. The distal work is like examining a room with a lighted match, whereas proxi-

mal illumination is like flooding the whole room with light so that you can see it at once. There is no question as to the difference in the tube and the view of the bronchial tree in the two methods of illumination. Each method has its particular use, wherein it is more successful than the other method. The difference is in the depth of the illumination. You can see into branches not more than 2 mm. in diameter that are in line with the bronchoscope. With the distal light one cannot see into the same bronchi, no matter how they are situated, because the light is too oblique to get into the bronchi. It is on account of the value of diagnostic work that I have read this paper today, because I want to call attention of the members of the society to the fact that in limiting the work of the society to bronchoscopies they are limiting themselves to the smallest and least important work of the specialty. Benefit can be given to a large number of patients by doing bronchoscopies for diagnostic work. We often get foreign body cases in patients where there is no history or X-ray findings, and where the case is brought in with other diagnoses. In one particular case I mentioned, the patient was brought in as a case of lung abscess with possible tuberculosis. It was referred for diagnosis, because we have made it a routine at Mt. Sinai in cases where the chest men are puzzled. The ability of the bronchoscopist to make diagnoses well will depend on his experience in doing the work. He can only gain his experience by cooperation with the internist.

XIII.

ATROPHIC RHINITIS: SOME FINDINGS IN A SERIES OF EIGHTY CASES.

By Gordon D. Hoople, M. D.,
Syracuse,
and
A. W. Rowe, Ph. D.,
Boston.

The study of this series of eighty patients was undertaken with the hope that some new etiologic factors or truths might be uncovered. The results proved to be very interesting but not those originally anticipated.

It is not necessary to present in detail a review of the pathologic changes present in atrophic rhinitis. It is sufficient to say that in its end results an atrophic rhinitis shows changes in the mucous membrane and turbinates of the nose. The former is changed from a ciliated to a stratified epithelium. The normal glandular structures, vessels, etc., of the turbinates are markedly diminished in number, having been replaced by connective tissue. The result is a nose with chambers abnormally wide, lined with a mucous membrane which no longer can perform the functions originally belonging to it. It allows the secretions in the nose to dry and form crusts, which are not easily blown out of the nose because of the wide passages. These crusts undergo putrefaction, and this causes the well known odor which beggars description.

With the above mentioned pathologic changes in mind, it is useless to think of curing a well established case of atrophic rhinitis. We cannot change connective tissue into glands, vessels, etc. Benefit may be conferred only by the establishment of the cause and the application of preventive measures.

The major effort of the current study lay in an attempt to relate the disease to other pathologic changes in the body. Several well known facts about atrophic rhinitis were taken into consideration. In the great majority of cases this condition

begins about puberty, and there is usually a very noticeable relief of symptoms in the fifth decade. In women, the symptoms are usually aggravated during the menstrual period. It was thought that atrophic rhinitis might in some way be related to an existing pathology in the endocrin glands. With this in mind, fifty of the cases were studied from an endocrin standpoint.

Prior to the endocrin study the cases were examined by the senior author. Many points of interest were elicited in this examination. In addition to the routine examination* each case had a Wassermann, and an X-ray of the sinuses was taken. Further, those cases which came first in the series had a bacteriologic examination. Owing to pressure of other duties this phase of the work had to be discontinued during the latter part.

As in all investigations of this type, the cases presented constitute but a fraction of those actually seen. Over 100 individuals with atrophic rhinitis were examined in the compilation of the present series of eighty.

With these preliminary statements in mind, the results of the examination of these eighty cases are given from the standpoint of the clinical and laboratory studies.

HISTORY.

Sex.—There were thirty-one men and forty-nine women in the group. This shows, as in most other series, a predominance of women. Thomson[1] mentions that it has been said to be five times as common in women as in men. Certainly this would not be true of the Throat Clinic of the Massachusetts General Hospital. The difference in this series between the sexes could easily be accounted for by the fact that women are known to be more particular about nasal conditions than men. We can only say, however, that the women outnumber the men, and this corresponds to the usual report in similar series of atrophic rhinitis.

Age at Onset.—It was more difficult accurately to establish the age of incidence and the mode of onset than any other

*The cases in this series were all drawn from the throat clinic of the Massachusetts General Hospital. The preliminary examination followed the standard technic defined by this institution.

feature of this condition. In a group of eighty there are necessarily many who have had symptoms twenty and more years. The mode of onset of a disease which begins as gradually as this does inevitably lacks clarity of outline after a lapse of twenty years. Yet this feature was made one of closest questioning, for it was felt that if accurate answers could be given to "when" and "how," "why" might be more easily solved. The onset was arbitrarily fixed as the time when crusting and odor first appeared. In practically every case these two symptoms began simultaneously. With these symptoms as the determining factor, the average age of onset was 14.9 years. The average age of the group at the time of examination was 25.9 years. Here we are faced with an average interval period of over ten years. This fact alone is sufficient to explain the lack of certainty in the chronologic order of the first symptoms.

The earliest onset recorded in the series was at 7 years of age. The oldest first noticed symptoms at 31 years. There were eleven over 20 years of age, only three of which were over 25 years. In none of these were the atrophic processes marked, nor were the symptoms severe.

From 7 to 10	19 cases	24 per cent
From 11 to 15	33 cases	41 per cent
From 16 to 20	17 cases	21 per cent
From 21 to 25	8 cases	10 per cent
From 25 to 31	3 cases	4 per cent

Thus 86 per cent dated their origin before the age of 21 years.

Mode of Onset.—The onset of symptoms varied from those who declared they had no symptoms prior to the odor of which they complained to those who had noticed a purulent nasal discharge for years prior to the arrival of crusting and odor. It was most difficult to extract an accurate history on this point. The patients were selected from a social group comprising many who would think little of a nasal discharge but who would ask for relief from an offensive odor. Again, there was a ten year average interval between the present examination and the onset. Knowing this, it seems significant that 49 cases (60 per cent) gave a history of a previous purulent nasal discharge. The recorded duration of this discharge ranged from three months to three years or more. Forty cases (50 per cent

of the total) said they had been bothered with the discharge for over a year. These patients did not complain of an odor with the discharge. There was no odor until there was crusting. This does not prove any definite point, but we believe there was a previous nasal discharge in a far greater percentage than could be deduced from the histories, and further, that there may be an important connection between this discharge and the development of atrophic rhinitis. This will be mentioned again under general discussion.

There were eight cases who attributed the onset to operative procedures. Four of these were tonsillectomies, two submucous resections, and two intranasal operations, the character of which could not be determined.

One patient stated her initial discharge was caused by a foreign body in the nose in childhood. Crusting and odor developed a few years later.

Two gave a history which stated that injury was the cause of onset. Each claimed he had broken his nose in childhood and symptoms started shortly after.

Crusting did not appear without odor, nor odor without crusting. They went hand in hand in the history and in the treatment. Mention of the latter will be made under that heading.

Family History.—No effort was made to examine the immediate families of these cases. We are convinced, however, that such a survey might reveal some interesting facts. Superficial observation of the relatives who came to the clinic with these patients disclosed six of the latter with whom at least one other member of the family had atrophic rhinitis. A communication from a colleague who knew some of the patients disclosed the fact that he had observed three other cases in the family of one patient, thus making four in one family.

Other Symptoms.—There were one or two symptoms, not already mentioned, about which there was frequent complaint. One of these was the derangement of the sense of smell. Inquiry was not made about this symptom in the first group of cases, so that the following facts relate only to the last sixty patients. It seemed surprising that there were so many who claimed to have no impairment of the sense of smell or taste.

Twenty-two claimed to have normal function of these senses. It must be remarked, however, that no tests were carried out to check these findings and that these figures represent only the patients' statements. Ten maintained a total loss of the sense of smell, while the remainder ranged from slight loss to nearly total impairment. The appearance of the nose seemed to have little to do with the amount of loss of the sense of smell. Several cases, where the atrophy seemed to be most marked about the superior half of the nose, were quite positive in their statements that there was no impairment of the sense. Others, where the process seemed to be only in the initial stages, claimed marked or total loss. Nor did the duration of the process seem to bear any relation to the degree of alteration of the function.

It is true that the majority of those under 20 years retained some smelling power, and those who had the disease for years, in the main, showed diminished perceptive power in detecting odors. However, there were two under 20 years of age who claimed complete loss in less than two years after onset, and who gave no history of other diseases which might account for the loss. They showed but little atrophy. On the other hand, there were five who had been the victims of atrophic rhinitis for over 15 years—the average would be about 20 years—in whom the atrophic processes were well marked, who claimed that their sense of smell was keen.

Another symptom, of which a few complained bitterly, was headache. About one-third of the group, 26, to be exact, stated that they were bothered with headaches. In every case the pain was frontal in character. The headaches did not have any well marked periodicity. The majority described the condition as that which is often given in the history of a chronic maxillary sinusitis. However, in this group the headache did not follow sinus involvement. There were a great many in the series who, by X-ray, showed pathology in the sinuses who did not complain of this symptom. Over 25 per cent of those who did have headache had negative X-ray findings. Headache bore no relation to the amount of involvement of the nose. Whether there was marked or but little change seemed to make no difference as to the presence or absence of headache.

It was surprising how few complained of a dry throat. It is true that there was no inquiry made as to whether or not this symptom was annoying the patient. Among the first cases this was done, but it was soon found that attention had been called to a previously unnoticed symptom, for which little could be done. Only six offered the information that this was an annoying symptom, while 20 cases, or 25 per cent of the total, showed changes in the pharyngeal mucosa. These changes varied from those which were just perceptible to the characteristic picture of a dry glazed throat with adherent mucopus or crusts.

Here was another symptom that showed seeming independence of duration or degree of pathology. It is only necessary to say that two men, both over fifty, and two women, both over forty, all of whom had marked atrophic changes in the nose, had no noticeable atrophy of the pharyngeal mucosa. On the other hand, there were several who did not show such marked changes in the nose and who had the condition but two or three years, who had the typical dry throat.

Why only six complained of this dryness cannot be said, unless the odor and crusting is to some a far more important condition from which relief is sought. However, when dryness was complained of it seemed to the observer (G. D. H.) that thereafter there was an insistent, unceasing plea for relief.

Epistaxis, aural and gastric symptoms, etc., were mentioned here and there, but did not seem to occur with enough regularity to warrant discussion. Their causes are obvious.

EXAMINATION.

As had been mentioned, there were changes in the nose that varied from those which were just perceptible to those where there was almost a complete atrophy of the turbinates. The duration of the process seemed to have no relation to the amount of atrophy present. Some cases showed almost complete atrophy of the turbinates after one year, and others but a moderate degree of change after 25 years' duration.

The atrophic changes were more frequently (65 per cent) bilateral and equal. The remaining 35 per cent showed variations. There were nine cases with well marked deviations of the septum, who, when examined, showed considerably less

atrophy on the side of the deviation. On the other hand, four cases showed a deviated septum, and on examination the side of the deviation revealed the most atrophy. In most cases there was difference in the involvement of the inferior and middle turbinates, the former showing the greatest involvement. Thirteen cases showed very much more atrophy of the inferior than the middle turbinates. In these the middle turbinates appeared normal or even hypertrophied. It was rare that the inequality was reversed. There were but two cases where the middle turbinate showed more changes than the inferior.

The crusting was most often seen on the inferior and the anterior tip of the middle turbinates. However, crusting did occur in the upper half of the nose and on the septum. The septum was covered with crusts most frequently in those long standing, neglected cases where the crusts would come away as whole casts of the nose. Crusting was also present in the nasopharynx and pharynx, the latter being seen in only two cases; the nasopharyngeal crusting was less frequent than any of the other above mentioned localities. When crusting was present there was an odor, so well known that it needs no description here. When the crusting was relieved (see "Treatment"), the odor disappeared. This was invariably true.

It was not possible in every case to ascertain the focal origin of the purulent discharge. However, it did not appear in any case to be secreted from the mucosa as a whole. Most frequently it was seen to come from the middle meatus. However, in a good many cases it was not confined to this site but was seen to come from the superior meatus (sphenoid ostium and posterior ethmoid cells) and the nasopharynx. As shown by X-ray (see below), there were very few cases where there was pus locked up in the sinuses. Because of the atrophy present most of the sinuses which were infected appeared to be draining well. It would seem that this was one reason why local treatment (see below) in the nose improved so many.

In several of the far advanced cases, after the mucopurulent discharge was arrested, there remained in the nose a fair amount of a clear viscid mucus. This was seen usually on the inferior turbinates and the floor of the nose. It did not dry as readily as the mucopurulent discharge, and it required much less effort to keep the nose clean in this stage. Whether this

came from the somewhat atrophied mucous glands of the mucous membrane of the turbinates could not be determined. It did not appear to come from the region of any of the sinuses.

The examination of the pharynx has been discussed under the heading "Dry Throat." One additional comment may be made. The most marked changes in the pharyngeal mucosa were seen in those cases where crusting was most abundant in the nasopharynx. This was particularly true where the crusts were in the pharynx itself.

LABORATORY FINDINGS.

Blood.—Each patient in this series had two Wassermann examinations, one in each of the two laboratories involved. This double check was thought to be desirable in view of the statement that atrophic rhinitis has some relation to syphilis. There was not one in the whole group who showed a positive Wassermann. It is true that two patients examined in connection with this study, but naturally omitted from the group, were found to have a syphilitic rhinitis. They had the usual picture which superficial examination might confuse with atrophic rhinitis, but when the crusts were removed it was seen that there was involvement of the bony septum in each case. Again, as has been brought out clearly by others, the odors of the two conditions are not the same.

One case in the series, an unfortunate girl evidently lacking in mental balance, had previously given a positive Wassermann. She had faithfully followed antiluetic treatment, and over a period of months had had two negative blood examinations. It was after these that her nasal symptoms began. There was a nasal discharge four months prior to the arrival of crusting and odor. On examination her nose appeared to show a true atrophic rhinitis. She was under observation for one year and in that period showed improvement rather than regression under local treatment. Our examinations gave her two more negative Wassermanns. This case is cited as the only one in the series in which there was any known syphilitic history.

Bacteriology.—As has been stated previously, only the first cases in the series had a bacteriologic examination, so no percentages can justly be recorded. However, it may be mentioned that those tested showed no consistency in the bacterio-

logic findings. A coccobacillus was the most frequently found organism, but it was not always present, being found in only half the cases examined. A mixed growth of various organisms, such as might be found in any nose, was the typical finding.

A word should be said here about the use of the vaccine made from Perez coccobacillus. There were three cases who had received this treatment over a considerable period several years prior to the present examination. One gave a story of relief from symptoms, but had returned because of frequent sneezing and excessive watery nasal secretion. These latter symptoms had developed after he had moved into a new home about a year previous to examination. Examination of this patient's nose showed a vasomotor rather than an atrophic rhinitis. There was a suggestion of the inferior being smaller in proportion to the middle turbinates, but it is doubted if this would have been noticed if the previous record of atrophic rhinitis had not been on his dispensary card. Those notations mentioned that the process was fairly well marked at the time treatment was started. A ten year interval had passed to the present examination. It was intended that he have the routine endermal tests but lack of cooperation prevented.

The other two cases who had received the vaccine treatment —the duration was over a year in each case—reported no improvement, and examination of the nose showed rather an advancement in the condition.

These numbers are too small to form any conclusion as to the value of the vaccine therapy. They are cited merely for the interest they may have to those who have used this method of treatment.

X-Ray.—Each one of the eighty cases had X-rays taken of the sinuses.*

The following findings are based upon the interpretation of the films and upon a discussion of the subject as a whole from an X-ray standpoint. Twenty patients, or 25 per cent of the group, showed no pathology in the sinuses demonstrable by X-ray. The remainder, or 75 per cent, showed some patho-

*The films were read by Dr. A. S. McMillan of the Massachusetts Eye and Ear Infirmary, to whom the authors take much pleasure in expressing their indebtedness.

logic change. This varied from slight thickening of the membrane lining these air cavities to the demonstration of retained pus in them, and from involvement of a single sinus on one side to that of all the sinuses on both sides.

It so happened that the first five or six radiographs showed quite small sinuses with little or no pathology. It was thought that this might be a consistent finding and give some basis to the anatomic theory of the cause of atrophic rhinitis. As the numbers increased, however, it was found that the size of the sinuses varied considerably. However, there were fourteen cases in all where the report expressly noted the small size of the sinuses. In these there was a corresponding increase in width of the nasal chambers, and in all of them the atrophic processes were well marked.

The antra showed the most frequent involvement, forty-five cases showing pathologic changes. The ethmoid sinuses ranked next with twelve. The frontals were mentioned six times and the sphenoid but three. In several of these more than one sinus was involved. In addition there were eleven cases of bilateral pansinusitis.

Amongst all these there were only eight in which there was X-ray evidence for accumulation of pus in a sinus. Each of the eight showed pus in one antrum.*

The outstanding report, from the standpoint of frequency, was "thickened membrane in both antra." A great many of these had antral puncture with irrigation—a good number had this repeated several times—but it was never possible to demonstrate accumulated secretion where the X-ray failed to show it.

As in the case of the small sinuses, when there was pathology demonstrable by radiograph in the ethmoid sinuses (twelve cases) there was a marked degree of atrophy in the nose.

Those whose radiographs were negative did not show less atrophy and crusting than the remaining 75 per cent. In fact, six out of the twenty negative cases were far advanced, and one of these showed more crusting than any other case in the series. Again, those who showed pathology in the sinuses were not necessarily further advanced than those whose sinuses

*These were referred for operation.

were negative. There were many whose complaints were not marked and whose findings were not advanced, who yet showed pathology by X-rays, while the more advanced case might have a negative picture. Radiograph of the skull showed no demonstrable pathology.

Dr. McMillan commented especially on the frequency of thickening of the membrane in the different sinuses. In his opinion it was noteworthy that the primary atrophic condition was so frequently associated with hypertrophic changes in the adjacent tissue. Especial note was made of the infrequency of retained secretion. It would seem that while there was often considerable pathology in the sinuses there was usually no obstruction to drainage.

ENDOCRINE STUDY.

It has been suggested that the primary condition might derive from some endocrin malfunction. As the endocrin glands severally are among the potent regulators of body metabolism, and as cases of atrophic rhinitis usually present definite evidence of metabolic disturbance, a measure of plausibility accrues to the conjecture. Should an endocrin etiology be demonstrated, a direct channel of approach for treatment would be opened, from which distinct benefit might be anticipated.*

To evaluate the endocrin possibility, a series of careful clinical and laboratory studies was instituted with a group of selected cases. The details of this study are presented in the next section of the paper.

The details of the general method of procedure have already been briefly presented in preliminary form,[3] and several clinical reports of results obtained by its use have already appeared.[4]

Briefly stated, it may be said that a series of socalled vital function tests are applied to each patient under controlled conditions. The tests selected have in turn been standardized, first by application to groups of normal individuals whereby criteria of normal performance were established, and subsequently to other groups in whom a presenting endocrin mal-

*Drury's results[2] from similar studies in otosclerosis offered a further measure of encouragement.

function was demonstrably present as the result of earlier surgical intervention. This latter group comprised male and female castrates and surgical hypothyroid and hypopituitary cases.

The fact that the adrenals are essential to life precluded their representation by surgical cases, but several established Addisonians were included in this phase of the study. This second set of observations determined both the sense and amount of deviation produced in each test by unmistakable endocrin pathology, and established an objective basis for the evaluation of aberrant function of the several ductless glands. In addition, each case received a very complete and thorough physical examination, and this was supplemented by the careful compilation of the full medical history. A primary condition of the method lies in the elimination of nonendocrin pathology by test and observation before applying any of the facts elicited to support an endocrin diagnosis. This has implied the cooperation of a consulting staff of some twenty workers in the specialized fields of medicine.

By the interpretation of the subjective evidence in terms of the objective facts derived by test and measurement, and with the elimination of a participating nonendocrin pathology by the same objective methods, it is felt that the final establishment of an endocrinopathy rests on a sound foundation.

Reverting to the actual detail of operation, each patient was first given a brief intensive study, the details of which can best be presented in tabular form:

TABLE I.

SCHEDULE FOR SHORT FORM STUDY.

Patient arrives at 7:45 to 8 a. m., in fasting state and with full 24-hour urine collection completed on morning of test.

8:00 a. m.	Basal metabolism.
	"Vital capacity."
	Alveolar carbon dioxid.
9:00 a. m.	Blood for chemistry and serology.
	Blood for morphology.
9:10 a. m.	Injection of phenol sulphone phthalein.
	Begin physical examination and history taking.

10:10 a. m.	First P. S. P. collection.
	Complete physical examination and history.
	Begin consultations.
11:10 a. m.	Second P. S. P. collection.
	Continue and complete consultations.
12:30 to	(Where desirable, a light breakfast may be provided at this time.)
1:00 p. m.	Patient discharged.

In the very complete blood and urine examinations, only methods of the highest obtainable accuracy are employed. If so many consultations are indicated that they cannot be performed in the single morning, later appointment with the patient is made for their completion. This same provision applies equally where time consuming observations, such as the Mosenthal kidney function and gastrointestinal X-ray series, are felt to be necessary. Final opinion is rendered only after completion of all indicated tests.

This method in the great majority of cases will allow for decision as to an endocrin element, and in an appreciable percentage will define the primary glandular focus of involvement.*

Where final decision may not be reached as the result of this brief study, the patient is admitted to the hospital for a seven day period of observation, this permitting a much more thorough and comprehensive study. The details of this elaborate program may well be omitted in the interest of brevity. (See Rowe: Paper soon to appear.)

In the present study fifty cases were given the brief examination and three of these subsequently completed the more extensive program of tests. As a result, 40, or 80 per cent, were demonstrated to have no indication of an endocrin pathology, while the remaining 10 all gave concrete evidence of a disturbed endocrin function which could be localized. As the two

*A study of nearly 2000 cases by these methods has shown that the socalled pluriglandular syndromes, if they exist at all, are of the utmost rarity. The series mentioned contains but two cases (0.1%) to which this designation in the conventional sense may warrantably be applied. Sound judgment would consider the plurality to arise as probably from the limitation of knowledge of the observer as from the existence of a true multiglandular involvement.

groups are so sharply differentiated, they may, to advantage, be considered separately.

A. NONENDOCRIN GROUP.

The presentation of data of this character in tabular form is not entirely satisfactory, as significant divergences in the individual cases above or below a normal standard may be merged to a misleading normalcy in algebraic summation. With due recognition of this fact, the form of presentation, so far as possible, is adapted to minimize this disadvantage. Some data must be omitted, however, as no form for condensed presentation is possible.

Certain physical measurements and significant statistics have been collected in Table II.

TABLE II.

PHYSICAL MEASUREMENT AND "VITAL CAPACITY."

No. of Cases	Sex		Obs.	Age	Hei't	Sitting Hei't	Chest	Wt.	Lung Cap'ty
	M	F	High	57	177.5	94	100.5	84.0	4550
40	18	22	Low	10	131.5	73	60	25.5	1550
	45%	55%	Aver.	26	160.5	86	77	53.8	2850
Sitting Height Index				"Vital Cap'ty"		High	+25	+39	+10
0.536						Low	—14	—23	—51
Area						+ Average	+8	+12	+4
1.55 sq. m.						%	48	35	13
						— Average	—7	—14	—20
						%	52	65	87
					Net Average		±0	—5	—17

Inspection of its contents discloses the following points: The incidence of the sexes approaches a parity. While the ages show a fairly wide range, the average age is less than for a number of similar etiologic groups. The youth of many of the patients also determines the rather low figures for height and in some measure for weight. The sitting height index is slightly but not significantly above the usual average.

Raw data of absolute measurements frequently fail to exhibit differences which are significant but not striking. Comparisons with standards in which allowances for fixed variables are intrinsic are frequently more informative. Dreyer ("The Assessment of Physical Fitness," Hoeber, N. Y., 1921) has computed such a series for the prediction of weight, chest girth and lung volume based upon certain biometric criteria. West[5] has developed a similar group of standards for the lung vol-

ume alone. As has been shown (Rowe[6]), only the Dreyer comparisons with the sitting height ("trunk") correlation are to be regarded as representative. Similarly his male standard "A" and female standard "B" most nearly conform to observations in this country. The West generalizations take cognizance of weight (area) and total height. By averaging Dreyer's single prediction with the average of the two West comparisons, it is felt that the several factors are suitably weighted.

Turning to the data of the table recording these comparisons, it is seen that two-thirds of the cases are definitely underweight and the net average falls below the prediction. This is a clearcut evidence of metabolic disturbance, as the average for similar groups (where wasting disease is not the basis of the allocation) will usually be found to exceed the predicted normal. The loss of lung capacity equates with the weight pictures but is of a magnitude to be regarded as tendential rather than established. Certain of the urine findings are informative.

TABLE III.

URINE MEASUREMENTS.

URINE ANALYSIS		NITROGEN PARTITION	
Observation	Amount	Observation	Amount
Volume, high (ce)	2860	Total nitrogen, high (gms.)	15.90
Low, ce	370	Low (gms.)	4.65
Average, ce	1280	Average (gms.)	10.54
Specific Gravity, high	1.033		
Low	1.006	Urea nitrogen, av., per cent	79.6
Average	1.020	Uric acid nitrogen, av., per cent	2.0
Albumin, per cent	15	Ammonia nitrogen, av., per cent.	3.4
Casts, per cent	5	Creatinin nitrogen, av., per cent.	3.9
Sugar, per cent	0	Residual nitrogen, av., per cent.	11.1
"Urobilinogen"	0	% equal to or greater than 9%.	68

PHENOL SULPHONE PHTHALEIN

Observation	Amount
Two hour elim., high, per cent	86
Low, per cent	38
Average, per cent	60

The average elimination is entirely normal, and this conclusion finds confirmation in the phthalein test. The relatively low incidence of albuminuria and the small number presenting casts possibly reflects in part the relative youth of the series. From the findings, however, it is clear that the urine gives no evidence of any general nephritic tendency.

The nitrogen partition exhibits several points of significance. First, the average nitrogen elimination indicates a very fair

nutritional level. While it determines only the protein exchange, experience shows that this is the nutritive element most frequently presenting inadequacy. Several factors participate in this, and a discussion at this point is hardly germane to the text. The principal interest lies in the fact that this normalcy emphasizes the inference drawn from the underweight condition of the group.

Additional support is found in the abnormally high residual nitrogen moiety of the partition analysis. Two-thirds of the cases are above the upper level of normalcy, and the average exceeds this by a strikingly large amount (over 20 per cent). It has been shown (Rowe, l. c.) that this condition is found in many endocrin conditions and with almost equal frequency in a group of nonendocrin states involving metabolic disturbance. Primary focal infective processes frequently engender this condition. In an article shortly to appear (Rowe and Proctor: Unpublished data) it will be shown that this high residual fraction is composed not only by augmentation of the amounts of substances normally present in low concentration (amino acids, creatin, etc.), but also of nitrogenous material of unknown origin and character. Whether causative or resultant, the condition is to be associated with metabolic disturbance.

TABLE IV.

BLOOD CHEMISTRY (AND SEROLOGY).

Substance	High	Low	Ave.		Deviation	Per Cent
Nonprotein nitrogen, mgm.	42	24	31		> 35 mgm.	15
Urea nitrogen, mgm.	4.... 19	10	14		> 17 mgm.	3
Uric acid, mgm.	5.3	1.8	3.6	= Or <	4 mgm.*	22
Creatinin, mgm.	1.7	1.4	1.5		.....	....
Residual nitrogen, mgm.	22	11.6	15.2		.....	...
Sugar, mgm.	117	80	99		>120 mgm.	0
					< 80 mgm.	0

+ Wassermann, per cent	0
+ Kahn, per cent	0
+ Spinal fluid, no.	0
+ Schwartz-McNeil, no.	0

The blood chemistry (Table IV) confirms the conclusion of kidney integrity drawn from the urine findings. The picture is one of normalcy throughout. The several high blood uric

*All cases deleted with demonstrated gout or nephritis.

acids might have a significance, but their implication is wholly unsupported by other correlative observations. True, there are a few cases of early nephritis in the series, but the incidence is what could normally be expected in a group of forty individuals substantially drawn at random. Attention is called to the negative serologic tests. While these do not rigorously exclude lues, they render highly improbable its presence in significant frequency.

TABLE V.

BLOOD MORPHOLOGY.

General Exam.	Amount	Differential Count	Per Cent
Hemoglobin, high, per cent.	100	Neutrophiles, av.	65
Low, per cent	68	% > 75%	20
Average, per cent	86	Lymphocytes, av.	30
Erythrocytes, av. 10^6	4.96	% > 33%	30
Color index. av.	0.87	Eosinophiles, av.	1
Leucocytes, av. 10^3	8.74	% = or > 3%*	3
		Monocytes	4

The blood morphology presents nothing remarkable. True, the hemoglobin value is slightly low, but, in the main, both the general examination and differential count bespeak a definite normalcy. Single cases naturally present abnormalities, but these are to be referred to the individual and do not determine a tendency.

TABLE VI.

RESPIRATORY METABOLISM.

Observation	Amount	Observation	Amount
Basal metabolism—		Blood pressure, sys. av., mm.	115
Deviation, high, %	+15	Dias., av., mm	64
Low, %	—15	Pulse rate, av., per min	81
+ Average, %	+ 6	Respiration, av., per min	16
Per cent of cases	53	Temperature, av., deg. F	98.5
— Average, %	— 7	Alveolar CO_2, av., mm	42
Per cent of cases	47	% > 35 mm	100
Net average, %	±0	% = Or < 30 mm	0

The respiratory metabolism and concomitant data give but little evidence of any endocrin element in the group. The conventional practice of regarding ±10 per cent as defining the normal limits of individual variation has much to warrant it,

*All cases deleted demonstrating nonendocrin causes of eosinophilia.

but the values above are perhaps less significant than those below prediction. Basal rates, as observed, are usually maxima and the true rate may be significantly below that recorded. In the present series but three cases exceeded the conventional +10 per cent, and the highest of these equates with the more elastic normal limit of +15 per cent, which finds favor with many observers. The group of lowered function may be subjected to some brief additional discussion, as values between —9 and —15 per cent (the limits here observed) may be truly important. The cases were as follows:

TABLE VI—A.

S-751	—10%	Earlier syphilitic Undernourished and 13% underweight.
S-808	—12%	Physical examination suggests probable pulmonary tuberculosis. 20% underweight.
S-1029	—15%	Man of 55 with well established nephritis. Somewhat underweight.
S-1061	—13%	Undernourished and 18% underweight.
S-1087	—13%	Anemia. Hb. 75, eryth. $3.92.10^6$ Is 13% underweight.

Inspection of the data given above shows that in every case a tangible nonendocrin cause is present, to which the lowered basal rate probably refers.

Reverting to Table VI, the blood pressures show a downward and the pulse rate an upward tendency. This is significant in the light of the endocrin cases and will be discussed later in the consideration of them.

In a few of the cases, the sugar tolerance was determined. The results are in harmony with the nonendocrin diagnosis established for the group.

All of the cases had thorough examinations of the nose and throat as well as X-ray studies of the skull.*

Of the several consultations which were requested for the present group, only the audiograms exhibit any consistent concomitant condition. Six cases in the group gave definite evidence of hearing failure.

*These have been discussed in a previous portion of the paper.

To summarize the nonendocrin group, the only consistent indication is of a generally disturbed metabolism manifested in underweight, high residual nitrogen, slightly low hemoglobin and the other points touched upon in the running comment on the data. Tendency toward a fall in blood pressure and increase in pulse rate was also remarked. The group of ten cases exhibiting an endocrin involvement may next be considered under a special caption.

B. ENDOCRIN GROUP.

The ten cases composing this group show a further differentiation, which is conceivably germane to the thesis. Seven of these exhibit some form of thyroid malfunction, while of the remaining three, one is a gonad failure following a severe attack of mumps, the other two being bilobar pituitary failures. These latter cases may well be considered as individuals, and to facilitate discussion the salient data have been collected in Table VII.

TABLE VII.

Case Number	S-766	S-772	B-517
Diagnosis	P—	P—	G—
Sex	F	F	F
Age, years	12	20	38
Height, cm	137	165	161.5
Weight, kg.	32.0	63.2	52.5
Weight deviation, per cent	—2	+ 16	—7
Lung volume deviation, per cent	—17	—10	—33
Basal rate deviation, per cent	—21	—11	—12
Blood pressure, systolic, mm	94	110	106
Diastolic, mm	48	58	68
Pulse rate, per min.	70	67	69
Temperature, deg. F.	98.4	99.0	98.2
Alveolar CO_2, mm	34	33	37
Urine volume, cc	800	650	590
Specific gravity	1.008	1.026	1.023
Albumin	+	0	+
Casts	0	0	+
Sugar	0	0	+
"Urobilinogen"	0	0	0
P. S. P. elimination, per cent	57	66	15
Total nitrogen, gms.	3.08	6.27	3.68
Residual nitrogen, per cent	8.5	5.8	11.2
Galactose Tol. normal, gms.	20	40	40
Observed, gms.	60	>40	20
Deviation, per cent	+200%	+	—50
Nonprotein nitrogen, mgm.	30	33	26
Uric acid, mgm.	3.0	3.9	2.4

Sugar, mgm.	90	114	92
Hemoglobin, per cent	90	75	90
Erythrocytes, 10^6	5.33	5.24	4.59
Color index	0.85	0.72	0.98
Leucocytes, 10^3	7.90	7.00	7.90
Neutrophiles, per cent	39	65	60
Lymphocytes, per cent	50	27	36
Eosinophiles, per cent	4	3	1
Monocytes, per cent	7	5	3

Case B-517, the gonad failure following mumps, is fairly typical. The slightly low basal rate, low blood pressure, glycosuria, galactose tolerance lowered to 20 grams, low normal blood chemistry and general blood picture either suggest or are consistent with ovarian hypofunction. There is also evidence of some kidney impairment, though the low P. S. P. value must not be regarded as a true index of the degree. The blood chemistry naturally offers far more dependable information, and this negatives the implication of the dye test. This is naturally no more than a coincident condition, one in no wise associated with the atrophic rhinitis.

Of the other two cases, both bilobar pituitary failures, S-766 presents an involvement of considerable magnitude. With a sugar tolerance increased by over 200 per cent and a basal rate of —21 per cent, the picture is one of an established and marked failure of function. There is a partial protein inanition, as is shown by the low nitrogen elimination. Case S-772 is less clearcut, as the magnitudes of the several deviations are less pronounced. It is to be regretted that the sugar test could not be completed, but her negative response at 40 grams rules out the gonad completely and would ill accord with so moderate a thyroid failure as a basal rate of —11 per cent would connote. The question as to whether these two pituitary cases stand in any relationship to the atrophic rhinitis other than one of coincidence will be considered later.

It may be well to remind the reader that the laboratory observations which are being discussed form but one part of the complete picture. The diagnoses rest upon a clinical study that supplements and complements the objective findings here tabulated. Emphasis is laid on the latter, not only for their intrinsic significance but because their very nature permits of an approximate presentation within the circumscribed limits of a journal article.

Table VIII.

Diagnosis.	T +	T ±			T −		
Case Number	S-948	S-768	S-931	S-942	S-719	S-720	S-748
Sex	F	F	F	M	F	M	M
Age	23	17	14	23	24	11	50
Height	148.5	165.5	157	163.5	158	151	163.5
Weight	40.8	63.1	45.5	51.3	59.3	23.3	62.4
Weight deviation	—14	+10	—17	—15	+9	—24	+16
Lung volume deviation	— 9	— 2	—20	—17	—40	+ 2	—26
Basal rate deviation	+27	— 8	—11	+10	—25	—29	—17
Blood pressure, systolic	115	110	104	152	98	102	116
Diastolic	40	65	62	84	70	68	62
Pulse rate	95	95	90	108	71	64	54
Temperature	98.2	98.5	98.6	98.3	98.7	99.1	97.2
Alveolar CO_2	36	43	36	39	31	43	36
Urine volume	470	760	920	680	940	930	500
Specific gravity	1.023	1.021	1.025	1.025	1.019	1.020	1.020
Albumin	0	0	+	+	+	+	0
Casts	0	0	0	0	0	0	+
Sugar	0	0	0	+	0	0	0
"Urobilinogen"	0	0	0	0	0	0	0
P. S. P. elimination	63	71	58	65	64	66	53
Total nitrogen	3.68	9.40	14.15	6.20	10.68	12.25	5.61
Residual nitrogen	11.2	7.8	14.2	7.8	6.7	13.3	13.5
Galactose tol. normal	—	—	40	30	40	—	30
Observed	—	—	40	glycosuria	40	—	30
Deviation	—	—	±0	<N	±0	—	±0
Nonprotein nitrogen	25	31	32	30	32	30	50
Uric acid	3.7	3.0	3.4	2.7	3.6	3.0	3.6
Sugar	93	97	119	103	95	100	100
Hemoglobin	85	80	100	100	90	85	75
Erythrocytes	5.15	4.42	5.09	5.82	4.73	4.01	4.62
Color index	0.82	0.90	0.98	0.86	0.95	1.06	0.81
Leucocytes	6.90	6.40	9.20	6.50	5.20	6.40	5.30
Neutrophiles	52	50	64	73	37	52	72
Lymphocytes	45	44	30	26	57	40	22
Eosinophiles	1	3	2	0	3	2	0
Monocytes	2	3	4	1	3	6	6

Table VIII presents the thyroid cases grouped as nearly as may be in accordance with the seeming functional level. In the dysfunctional group, which contains the transitional cases, several stadia of decline are manifest from the incipient involution of S-942 to the approaching hypofunctional level of S-931. Of the hypofunctional group, S-748 may be regarded as standing midway between S-931 and the 11-year-old boy, S-720, who presents a typical thyroid failure of moderate degree, relative ages determining certain of the levels recorded. A detailed analysis of the seven cases is hardly necessary, but a few points require some explanation. The omission of the sugar tolerance with S-948 is implicit in the clearcut hyperthyroid state that was apprehensible. Case S-768 was a 17-year-old girl who had not yet matured. The clinical picture was most suggestive of incipient thyroid failure as a sequel to an earlier state of mild overactivity. The boy, S-720, presents a basal rate at a level which in the cases studied by this method is observed only with thyroid failure, advanced adrenal disease, starvation and in greatly emaciated diabetics, and afebrile cases of tuberculosis. The various observations on the patient eliminated all but the thyroid possibility, and the general picture was entirely confirmatory of this diagnosis. It would have been preferable to have determined sugar tolerance in every case, but as the operation is a time consuming one the cooperation of the patient could not always be secured.

Omitting case S-748, whose age does not equate with the remainder of the group, and so introduces another factor of variation, the following comparison is interesting:

TABLE VIII-A.

Case No.	S-948	S-942	S-768	S-931	S-719	S-720
Basal rate	+27	+10	—8	—11	—25	—29
Pulse rate	95	108	95	90	71	64

That there is a rough correlation is evident. Experience has shown that in the transition states of the involuting thyroid the various physical factors characterizing the hyper state do not recede with a uniform velocity. The tachycardia lags behind basal rate and other changes, and only in the well established and moderately severe hypofunctional cases does the

terminal bradycardia manifest itself. This is less true in the later years of life, when other agencies tend to augment the depression of the pulse rate. Case S-748 seemingly illustrates this.

GENERAL DISCUSSION.

The analysis of this group of fifty cases presents certain facts which are highly suggestive. Of the fifty, forty, or 80 per cent, give no evidence of any endocrin disturbance, but do show clearly unquestionable metabolic derangement expressing itself through various objective and subjective channels. Of the remaining ten, one case, B-517, presents an endocrin disorder, but one obviously unrelated to the presenting condition. Two cases of pituitary failure occupy a debatable middle ground, while seven cases show a definite and clearcut state of thyroid malfunction. The predominance of this single glandular involvement can hardly be fortuitous, even in so brief a series as the present.*

		Per cent of endocrin
Not endocrin	346	
Pituitary	327	50
Thyroid	135	21
Gonad	158	24
Adrenal	16	2
Pluriglandular, surgical	18	3

The relative incidence of thyroid involvement in this series shows no correlation with its occurrence in the atrophic rhinitis group.

That the thyroid gland exercises a profound influence on certain phases of body metabolism is too well known to merit discussion. Equally, infective processes are among the well recognized causes of thyrotoxicosis, there being, however, a variety of other etiologic agencies unassociated with infection. Further, infections produce toxemias as characteristic end results, and these in turn engender metabolic disturbances protean in character and manifestation.

All of the cases in this group have one definite point in common, namely, they exhibit the various symptoms which united define the syndrome of atrophic rhinitis. They present

*While the figures must be taken as a first approximation only since extraneous influences supervene in some measure, an analysis of 1000 putative endocrin cases yields the following division:

uniformly evidences of infective processes and uniformly like evidences of metabolic disturbance. In the majority, these are unaccompanied by an indication of an endocrin complicity, but in a significant moiety aberrant thyroid function can be demonstrated.

The interpretation of these facts offers several possibilities as one subscribes to the detoxication or hormonal theories of thyroid overactivity.*

The hormonal theory certainly marshals a most impressive array of supporting evidence and has enlisted the support of the majority of workers in this field. For the real purpose of this thesis, however, it is possible to waive controversial discussion and focus on a single significant point.

Whatever be the basis of the manifestations of thyrotoxicosis, lack of thyroid normone (or more probably hormones) determines the picture of hypothyroidism. Experience has shown, further, that initial hyperactivity may undergo a spontaneous arrest through the action of unknown agencies and passing through a series of intermediate steps ultimately determine a true thyroid failure as the terminal phase.†

The cases here presented offer several of the stadia of such a functional progress.

To summarize, then, the study of these cases comprising the entire group leads to a plausible conclusion that while atrophic rhinitis does not have an etiology dependent on endocrin malfunction, it does engender a variety of metabolic derangements and these, in turn, in certain cases may give rise to a resultant and secondary endocrin involvement. To the obvious suggestion that the sequence is in reverse order and that the forty apparently nonendocrin cases are all cases of incipient thyroid disease with the rhinitis as the chief presenting symptom there are several answers.

First, the relative severity of the two conditions shows no trace of correlation.

---

*It is not essential to assume a dysthyroidism for Graves' disease. Excess of normal secretory activity with overproduction of the thyroid hormones is as plausible as the assumption of a modified agent rendered toxic through change.

†An endocrin analogy is exhibited by the functional changes frequently observed in the progress of acromegaly.

Second, atrophic rhinitis is a condition of relative infrequency, at least in comparison with the incidence of thyroid disease.

Third, the literature contains no record of cases indicating an initial thyroid condition eventually developing rhinitis. This series, on the other hand, offers definite evidence to support the chronologic relationship of secondary thyroid involvement.

In other words, it is felt that the present study throws no light on the etiology of atrophic rhinitis, but does indicate that the condition, as might be expected, gives rise to a variety of metabolic disturbances. Further, that in certain cases and for unknown causes, these metabolic aberrations may give rise to disturbances of the thyroid gland as one sequel among many.

The two pituitary cases have purposely been excluded from the foregoing discussion. The anatomic relationship of the pituitary to the seat of the presenting condition is suggestive. Equally tenable would be the fortuitous and unrelated occurrence of pituitary failure in individual cases of atrophic rhinitis or any other morbidity. That a causal relationship exists is hardly possible—certainly is not suggested by any of the other observations.

TREATMENT.

The intranasal treatment carried out was done for the relief of symptoms, and as such has but passing interest in this paper. Only when it was felt that there was an empyema of one or more sinuses or chronic infection in the adenoids and tonsils was operative interference invoked. There were so few of these that no just conclusions can be drawn. However, in justice to the operative procedures it should be said that they all showed improvement. The discharge was markedly lessened and, as a result, the crusting was negligible, even without local treatment. In a few cases, not only did the atrophy cease, but the turbinates seemed to be larger than prior to the operation. But the great majority of the cases received only simple intranasal treatments. The old standby, the alkalin nasal douche, was supplemented by local cleansing during visits to the clinic. In addition, tampons of argyrol, 10 per cent, were used. These seemed to lessen the purulent char-

acter of the secretion more quickly than in those cases where it was not used. Naturally, this was an aid in relieving the crusting.

There were no cases in the group, who, following faithfully the treatment outlined, did not have a discontinuance of crusting. With this there was relief from odor.*

In a great many the discharge abated. These did not need local treatment.

It is probable that with a more careful consideration of each individual case some would have responded more satisfactorily to the operative than to the nonoperative treatment. Had time availed this would have been done.

It seemed, and this is more important from the standpoint of the cause of the atrophy, that once crusting was eliminated the atrophic processes stopped. This statement is made tentatively and with just recognition of the difficulty of judging atrophic changes in the nose. There are no means of measuring them, and reliance must be placed upon memory, which is most susceptible to misleading influences. Again these cases were followed over a period of months rather than years, and proof could be adduced only after protracted periods of observation. However, no advance of atrophy was observed in any case after crusting ceased. There were several patients who were very negligent and who continued to have crusting. These showed a fairly rapid progress of the atrophy from time to time.

DISCUSSION.

It has probably been noticed that this paper, although not mentioning the point, has brought out the variability in the findings in this group of atrophic rhinitis cases. It may have done this to the confusion of the reader. But this variation, in the minds of the authors, has been one of the outstanding features of the series. A few cases would each present a certain finding. This would arouse interest as a possible etiologic factor. Then the following cases would fail to exhibit this symptom. There is no better example of this than the result of the first five or six X-rays. They all showed small sinuses

*There were those who continued to have some crusting, but invariably it was found that they were careless as to their treatment at home.

and wide nasal chambers. Seemingly, here was a clue to be followed. It might establish the anatomic theory of the cause of this disease. But there soon followed picture after picture with large sinuses, which showed no deviation from those seen in chronic sinusitis.

So it was with the other familiar theories. A few cases would show the same bacteriologic findings. Then the following cultures might show an entirely different picture. There was no organism that was always present in all the cultures. Nor did the accessory sinuses always show pathology. True, there were a good number that did, and it may be that some of those reported negative by X-ray were not free from pathology. But the findings here were not consistent enough to warrant the dictum that chronic sinusitis is the cause of atrophic rhinitis. To this variability in the findings we will return later.

As far as the evidence in this series goes neither syphilis nor tuberculosis has any patent etiologic relation to atrophic rhinitis. Some cases of syphilis or tuberculosis may have passed unrecognized, but the percentage must be so low as to be negligible from an etiologic standpoint. The only case in the group which had a syphilitic history had repeated negative Wassermann tests after a course of antiluetic treatment. The family history of seven was positive for cases of tuberculosis among the immediate relatives, but the association in several of these was wholly insignificant. There were several who, on physical examination, showed suspicious signs in the chest, though they had a negative history. All of these had X-rays of the chest, and each had a negative plate. One case in particular had spent some weeks in a sanatorium. His physicians had never found a positive sputum nor could they show evidence by X-ray that tuberculosis was present. The patient was having a rather profuse postnasal discharge. He had never had nasal treatment. After several treatments he reported that he was feeling better than he had felt in years and that his cough was almost gone. Admitted that these facts do not absolutely rule out the above mentioned infections, they are negative as far as the tests here considered are concerned. In any case, we feel the possible percentage is so small that tuberculosis or syphilis must be concomitant in atrophic rhinitis rather than causative.

The evidence of the endocrin study apparently warrants the conclusion that malfunction of the ductless glands as the cause of atrophic rhinitis is not tenable. Rather is the reverse true. Atrophic rhinitis in a certain number of cases seemingly causes a functional deviation of the thyroid gland from normal.

The authors wish to emphasize that the results of this brief series of cases do not render invalid all the previously mentioned theories of causation. It is a fact that the results of this study do not support them.

One familiar theory has not been mentioned in the foregoing discussion. The idea was propounded by Bosworth that atrophic rhinitis is preceded by a purulent rhinitis which causes destruction of the normal ciliated epithelium. This change is followed by an accumulation of secretions in the nose, due to the replacement of ciliated by squamous epithelium. The secretions dry, forming crusts, which accumulate in the nose. Then follows a replacement of normal structures by connective tissue. There is a sclerosis of the tissues, particularly the inferior turbinates. This allows a greater accumulation of crusts which but continues the process already described. Others have substantiated the pathologic findings of this picture. It is mentioned here in some greater detail than the other theories because it seemingly has a sounder pathologic background. The origin of the discharge does not seem to be of primary importance, whether it be from a simple purulent rhinitis, a sinusitis, or from chronic infection in the adenoid tissue in the nasopharynx. It is sufficient that there is a discharge which will follow the cycle outlined above. Certainly a definite majority of the series, 60 per cent, gave this history, and this despite an average interval from onset to present examination of ten years. Tenable as this would seem to be for a single theory, it does not explain the cases who insist that prior to the crusting and odor there was no discharge. This item was not particularly noted in the histories of several, but at least 10 per cent of the group so stated their cases.

There is, of course, a marked variability in a series of this size in any disease. This is due largely to the resistance of each individual to the progress of the disease. This factor undoubtedly plays a part in the variability of findings in atrophic rhinitis but does not account for all of it. It could be

explained by assuming that atrophic rhinitis does not have one single cause but is the end result of a combination of etiologic factors.

If we have a mucopurulent secretion on the one hand and enlarged spaces in the nose which allow the secretions to dry and form crusts on the other hand, we have the combination of factors necessary for the condition known as atrophic rhinitis. Any condition which would abnormally widen the nasal fossæ would be one etiologic factor. Any condition which would furnish a mucopurulent secretion in the presence of the widened nasal fossæ would be the other necessary etiologic factor. Thus anatomically wide nasal fossæ (developmental), which show on X-ray as having small sinuses, deviation of the septum, loss of ciliated mucous membrane, inhibition of cilia present and like conditions create the picture upon which the remainder can be grafted. Into the other side of the picture any of the well known theories would fit—purulent rhinitis, chronic sinusitis, bacteriologic infection, diseased adenoids, etc. And it is entirely possible, on the basis of the pathologic changes outlined in Bosworth's theory, that a purulent rhinitis, existing first, may create the abnormally wide nasal chambers and thus by itself establish the conditions necessary for an atrophic rhinitis.

Hajek[7] and Grünwald[8] have both written of their belief that in every case of atrophic rhinitis the source of the purulent secretion could be traced to some definite focus. They maintain that the mucosa as a whole does not secrete the purulent material found in these cases. It varies in different cases and may be from one or all of the following: maxillary, ethmoid, frontal or sphenoid sinuses, adenoids or tonsils.*

Hajek also mentions a hypertrophic condition found near the origin of the secretion with atrophy of more distant structures, principally the inferior turbinates. This was found in several cases of the current series in the examination of the nose.†

*This specificity was not established in every case in this series. More careful examination might have done so. Certainly we feel that the mucosa as a whole does not secrete the purulent material.

†Dr. McMillan's comment on the frequency of hypertrophy of the mucous membrane of the sinuses is interesting in the light of this statement.

After pointing to these findings Hajek asks why, in atrophic rhinitis, there is atrophy when in other instances of purulent secretion in the nose there is hypertrophy. A possible answer is found in the conditions present in the nose of the atrophic rhinitis patient. Here is a state which allows the secretions to dry, and the pathologic cycle already described begins and is maintained if this drying is allowed to continue. This would explain why the inferior turbinates are most frequently involved; the secretion naturally tending to gravitate to the most dependent portion of the nose. In other words, when the secretion does not dry we do not find atrophy. When it does dry we do find atrophy. Thus the atrophy apparently is not an entity by itself. It has a known pathologic background, as described above.

Among the cases not included in this group of eighty there were six youngsters, who were given a diagnosis of "preatrophic rhinitis." They all had wide nasal chambers and a mucopurulent discharge. Some showed questionable atrophy of the inferior turbinates. But none of them had had crusting. Five showed negative sinuses by X-ray; the sixth, pus in both antra. Appropriate treatment for the latter and cleansing treatment plus argyrol tampons for the former were instituted. In all the discharge ceased and there were no further symptoms. These were seen early in the series, so that at the time of the last visit there had been a six months' period of freedom from discharge. It would be interesting to see this group five years hence; to see if those who remained free from discharge showed any changes in the nose and to obtain the history of those who had a recurrence of mucopurulent secretion. They might throw some light of real worth on this problem. A large series of such cases watched through a period of years would certainly be an interesting study. These might prove to be the cases who, having the anatomic findings, need only the drying of the secretions into crusts to complete the picture.

There are several findings in this series which support this conception of the origin of atrophic rhinitis. The average age at onset was 14.9 years. The changes due to growth, about this period of life, are known to affect the size of the bones

of the nose and face. This additional widening of the nasal fossæ may be just enough to allow for the drying of the secretions present, with the consequent formation of crusts. Again, by X-ray, it was demonstrated that a fair number (fourteen) had small sinuses and wide nasal chambers. It was noted previously, also, that those who did not have symptoms till after twenty years of age failed to show marked changes. It is entirely possible that operations in the nose might change relations so that symptoms would develop, provided suppuration continued. There were four who claimed this. Also injuries might cause a change which might bring on symptoms. Two claimed this—both had wide flat noses, though whether as a result of injury is not known. There were several instances where there was more than one case in a family, which might be accounted for on the basis of similar development with a superimposed purulent condition in the nose. The lack of relation of the amount of atrophy to the length of duration of the disease does not seem so strange in the light of this view. Nor does the variability of the degree of pathology as revealed by X-ray compared to the degree of pathology as seen in the nose seem so remarkable. The patients who had no discharge prior to crusting might be those whose anatomic features, when discharge did come, allowed immediate drying of the discharge into crusts. And finally, it was noticed that when crusting was arrested the progress of the atrophic changes apparently ceased. The true worth of this last statement could only be determined by studying these cases over a period of years.

If the foregoing assumption should be true, then operative procedures to narrow the nose are correcting an essential condition for the further advance of the disease. Furthermore, in those cases where the ciliated epithelium of the nose has not been replaced to any extent by the squamous variety, the narrowing of the nose would change the status from an atrophic rhinitis to the usual picture seen in chronic sinusitis, etc. If, in addition, the origin of the discharge could be found and this be eliminated one might justly claim a "cure." In a neglected case, where the atrophy was far advanced and changes of the mucous membrane had taken place, operation might afford relief, but a "cure" could not be claimed.

SUMMARY.

1. Of eighty cases of atrophic rhinitis there were thirty-one male and forty-nine female patients.

2. The average age at onset was 14.9 years.

3. At the time of examination the average interval history (from onset to the present) was ten years.

4. Sixty per cent gave a history of previous purulent nasal discharge.

5. Every patient in the series had a negative Wassermann.

6. There were no consistent findings in the bacteriologic examination.

7. Seventy-five per cent of the cases showed, by X-ray, pathology in the sinuses. The antrum was most frequently involved.

8. Evidence seems to point to the fact that some factor present in atrophic rhinitis causes a disturbance, in some patients, of the normal functioning of the thyroid gland. In general, atrophic rhinitis has an adverse influence on body metabolism. There was no evidence obtained that pathology of the endocrin glands had a causal relation to atrophic rhinitis.

9. There was a remarkable variability in the findings of the patients in this group. This seems to be best explained by assuming that atrophic rhinitis is the product of a combination of factors rather than the result of any one cause.

It is fully realized that more work could be done on several of the phases mentioned. It is regretted that before this was done one of us (G. D. H.) changed residence, so these cases are no longer available to him. However, as Dr. H. P. Mosher[9] wrote in his paper on "Unsolved Problems of Otolaryngology," "We need a relay of workers because the cases are so unlovely that the workers must be spelled."

These facts are presented for what they are worth, in the hope that they may play a modest part in the solution of the problem of this disease, which brings so much discomfort, both mental and physical, to those who suffer from it.

BIBLIOGRAPHY.

1. Thomson, St. Clair: Diseases of the Nose and Throat, 3rd ed., p. 148.
2. Drury, D. W.: Bost. Med. and Surg. Jour., 190-1029 (1924);
Acta. Oto-Laryn., Vol. X, 90 (1926);
Annals of Otology, Rhinology and Laryngology, 35, 651 (1926).
3. Rowe, A. W.: Bost. Med. and Surg. Jour., 190, 26 (1924);
Ibid. 191, 151 (1924).
4. Rowe and McCrudden: Bost. Med. and Surg. Jour., 190, 121 (1924);
Ibid., 191, 60 (1924).
Rowe: Ibid., 192, 477 (1925).
Rowe et al.: Ibid., 192, 747 (1925).
Lawrence: Ibid., 190, 21 (1924);
Ibid., 191, 157 (1924);
Ibid., 192, 480 (1925);
Med. Clin., 8, 1779 (1925);
Annals of Otology, Rhinology and Laryngology, 36, 694 (1925).
Rowland: Bost. Med. and Surg. Jour., 191, 977 (1924);
Am. Jour. Ophth., 9, 178 (1926).
5. West: Arch. Int. Med., 25, 306 (1920).
6. Rowe: Am. Jour. Physiol., 72, 436 (1925).
7. Hajek, M.: Nasal Accessory Sinuses, Vol. II, p. 567-572.
8. Grünwald: Der heutige Stand der Ozaenafrage, Arch. f. Laryngol., 1903, XIII.
9. Mosher, H. P.: Transactions of the American Laryngological, Rhinological and Otological Society, Inc., 1924.

XIV.

SOME OBSERVATIONS ON AUDITORY CANAL INFECTIONS.

By Dunbar Roy, A. B., M. D.,

Atlanta.

It is the frequent and apparently the noncomplicating aural conditions which constitute the vast majority of our clinical cases.

During the summer of 1924, an unusually large number of inflammatory conditions of the external auditory canal were seen among the younger patients of my city, the etiology of which was traceable almost without exception to bathing in the city pools. Observation by otologists practicing at ocean resorts shows that the middle ear is much more frequently involved than the auditory canal, leading one to surmise that the traumatism produced upon the ear by the waves of the surf and the flooding of the nose and eustachian tube with sea water is the important factor in the former, while infection of the auditory canal is chiefly caused by bathing in city pools of inland towns.

It is not the purpose of this paper to discuss the histopathology of the external auditory canal, but rather some clinical observations gained from personal experience and the treatment which has proven most satisfactory.

Acute inflammatory conditions of the auditory canals may be divided into: (1) diffused; (2) circumscribed or furunculosis.

1. Diffused.—The lining of the auditory canal, being an epithelial or skin structure, must be subject to the same character of inflammation as other skin surfaces of the body. In addition to this, it has certain histologic characteristics and is exposed to certain pathologic bacteria which render it susceptible to morbid changes not possessed by other epithelial surfaces. For instance, an acute diffused inflammation of the auditory canal could be occasioned by such abnormal causes as:

1. Chronic discharge from the middle ear.
2. Foreign bodies in the canal.
3. Impacted cerumen.
4. Traumatism by toothpicks, hairpins, finger nails, etc.
5. Acute eczema and other skin eruptions in the canal.

Let us consider these in order:

1. A diffused inflammation of the external canal dependent upon the chronic discharge from the middle ear or upon a weeping eczema in the same locality have many similar characteristics. For instance, in both forms there will be a glazed red appearance of the whole canal, due to the destruction not only of the skin epithelium but in many cases a complete destruction of the sweat and ceruminous glands together with the hair follicles and vibrissæ. While the above conditions are more or less chronic, they frequently have exacerbation engendered by the pathologic state of the canal lining. When such does occur the whole canal becomes swollen and congested, there is tenderness on moving the auricle and frequently the pain is so severe as to produce great discomfort. Inspection of the canal shows no particular point of tenderness or point of fluctuation, but the pain may be almost as severe as in a case of discrete furunculosis.

If the acute inflammation is superimposed upon a red weeping eczema, the redness will probably extend outside into the pit of the auricle and, in addition to the pain, there will be the intense burning and itching sensation so characteristic of eczema. These canal inflammations are seldom followed by or accompanied with circumscribed pus formation, but as resolution progresses all swelling subsides and the canal gradually returns to its previous condition.

A large number of cases seen during the summer of 1924, probably the results of bathing and swimming in the pools, were of this inflammatory type without the presence of pus formation. These resemble more the type of tissue infiltration with tenderness and at no time exhibited the signs of pus. While pain and general physical reaction in such cases are not so severe as in the discrete furuncular variety, they produce, however, a great deal of discomfort and will occasionally require the best medical and surgical skill in their management.

Second Variety.—This form of canal inflammation is that which is designated as discrete furunculosis or pus pockets. The etiology of this form of discrete suppuration is exceedingly uncertain, just as the etiology of boils in other parts of the body is also an unknown quantity. Why some individuals should be thus afflicted it is difficult to say, and why some are always having boils in the ear while others have them on other parts of the body is a problem for the most astute internist. Certain it is that the points of predilection for infections are in the region of hair follicles and sweat glands.

The severity of auditory canal furunculosis depends in a great measure upon the location of the circumscribed pus formation—the more external it is, the less the pain and discomfort, because of the anatomicohistologic structure of the canal, resembling the socalled bone felon, due to the close adherence of the skin and periosteum to the bone, while farther externally there is more resiliency, permitting swelling and surgical relief by incision. While the etiology of the auditory canal furunculosis can frequently be traced, there are many cases where this is impossible, except on the theory of constitutional dyscrasia.

The diagnosis of auditory canal furunculosis is usually made without difficulty, and yet if there should be a middle ear involvement and a canal furunculosis in the same ear such may prove exceedingly difficult. In these cases roentgenograms of the mastoid may prove of some assistance, but are by no means to be implicitly relied upon.

The following cases well illustrate this statement:

Miss M., age 17, student at college in Gainesville, Ga.—On May 10, 1924, the writer received a telephone message saying that this patient would arrive at his office in the afternoon on account of severe pain in her ear and all the symptoms of a mastoid involvement. In due time the patient arrived and a thorough examination revealed the following history: Three days previously the patient was seized with a severe pain in the left ear, which gradually increased in severity, to be relieved only with anodynes. Examination by the writer showed the following: The features were drawn, indicative of severe pain. The left ear was very sensitive to pressure

over the mastoid. There was also some swelling in the same region. There was a history of a middle ear discharge several days previous. The auditory canal was so swollen that the walls were in contact. It was impossible to see the drum membrane. There was some moisture in the canal. Temperature was 102° F. Headaches with general discomfort. An X-ray examination showed a possible involvement of the mastoid. Depending upon my own clinical experience, which, after all, must be the final arbiter, the writer decided that a general furunculosis of the canal was present. Phenacetin and salol were given and a large subcutaneous injection of staphylostrepto vaccine administered, free catharsis and hot fomentations. The next morning the temperature was normal, pain subsided and there was a rapid recovery from what proved to be a correct diagnosis.

During the same summer the writer had three other cases where all the symptoms were practically identical with those in the above case.

On the other hand, my colleague, Dr. Equen, had under his care a case where the outcome was different.

Mr. H., age 26, was referred to us on account of severe pain in the right ear. On examination he found a severe inflammation and bulging of the drum membrane, indicating an acute otitis media. A free incision was immediately made, with the escape of bloody serum. Temperature 101° F. Hot irrigations with hot fomentations were immediately instituted and the patient put to bed. The next day the pain seemed to be as severe as ever, and in addition the canal was swollen, the auricle tender to the touch with considerable sensitiveness over the mastoid. Anodynes had to be administered. An X-ray showed the mastoid dark. The temperature being 101½° F., the mastoid operation was performed on the third day. A small amount of bloody serum was found in the mastoid antrum after going through thickened and edematous soft tissues. Pain was relieved entirely and the patient progressed rapidly to a complete recovery.

In this case it may be questionable whether the pain was relieved through the mastoid operation or the result was due to the exsanguination of the soft tissues.

Roentgenologists tell us that a shadow exists in the region of the mastoid when there is great infiltration of the auditory canal and that it is sometimes very difficult to differentiate between a severe auditory canal furunculosis and a mastoid involvement when the two are coexistent. No doubt many otologists have had these cases of canal furunculosis, especially in association with middle ear suppuration, where their diagnostic skill has been severely taxed in deciding whether or not the mastoid was involved.

The prognoses of these auditory canal infections have always been considered favorable in their outcome. The writer held to this opinion until the year 1912, when he reported to this society a "Case of Bilateral Furunculosis of Auditory Canal With Bilateral Sinus Thrombosis—Autopsy." The thrombosis occurred in the parietal sinuses and was of streptococcus origin, the infection evidently extending through the lymphatics or venous channels of the sinuses.

If one will refer to this article he will find a quotation from Toynbee's old work, which was the only reference to be found, reporting a similar case and where a clear exposition of the anatomic relationship in these regions could explain the possible occurrence of such an unusual result. Since this experience the writer has always considered the presence of a severe canal furunculosis as being by no means free from complications.

Treatment.—The writer's management of these cases has considerably changed in the last few years.

Formerly an early deep incision into the most sensitive part of the canal was the usual procedure in that it was frequently impossible to locate the exact point of pus formation. For the last few years he has limited this surgical procedure to those cases only where the localized pus formation was situated just within the external opening and where the fluctuation was distinctly evident on inspection. In those of the deeper situated variety we have been accustomed to keep the canal packed with sterilized cotton tampons saturated with some product of carbolic acid. A small tampon is insinuated well into the canal and the patient instructed to keep the same moistened. Liquid camphophenique, full strength, has proven

exceedingly satisfactory both for its germicidal and analgesic qualities. It seems to relieve the pain and aids the discharge of pus without surgical interference. For some time pure alcohol was used but its rapid evaporation made it unsatisfactory.

Another preparation which has proven satisfactory when the acute swelling begins to subside is the use of tampons saturated with a 5 per cent aluminum acetate solution. In addition to these procedures, hot fomentation is a most valuable adjuvant. The writer always uses a stock staphylostrepto vaccine, having found a decided value in its hypodermic administration.

If there is excruciating pain we see no reason why a narcotic should not be used and the patient be given a comfortable night the first twenty-four hours. If there are symptoms of a mastoid involvement in conjunction with great swelling and tenderness of the auditory canal, a delay of operative interference is frequently advisable, until we are more certain of a positive diagnosis.

XV.

THE INTRATRACHEAL INJECTION OF LIPIODOL THROUGH THE CRICOTHYROID MEMBRANE. A DESCRIPTION OF THE INSTRUMENTARIUM AND TECHNIC.*

By Jerome R. Head, M. D.,

Chicago.

In this country only within the past year has there been recognition of the value of iodized oil (lipiodol) as a contrast medium in radioscopy of the bronchial tree. The recent visit to America of Forestier, who, with Sicard,[1] devised the method, has done much to convince the profession that it is a distinct aid in the diagnosis of obscure pulmonary conditions and that it is a safe and justifiable procedure. The recent article by Pritchard,[2] Whyte and Gordon, J. K. M. (J. A. M. A., 1926, 86, 1119), has brought it to the attention of the profession at large.

In view of these facts and because the injection is a specialized procedure, it seems worth while at this time to describe the technic and instruments which for the past several months have been used on the thoracic service of Dr. C. A. Hedblom.

The oil may be injected in any of several ways. Those most commonly used and most generally applicable are the transglottic and the intercricothyroid. In the former the oil is injected through a curved canula which, under direction of the laryngoscopic mirror, is inserted between the vocal cords. In the latter it is injected after direct needle puncture of the trachea through the cricothyroid membrane. This method is the one which will here be described. The former is too specialized a procedure for anyone untrained in laryngoscopy,

*From the surgical service of the Research and Educational Hospital and the Department of Surgery of the University of Illinois.

and while it seems less radical is fully as trying to the patient as the simpler and more direct method. This can be used on all classes of patients, both children and adults, and requires no special training on the part of the operator.

The technic and instruments were developed by Rosenthal[3] and adopted for this particular work by Sergent and Cottenot[4] and by Armand-Delille, Duhamel and Marty.[5] The instruments here described were modeled after these and were made up by V. Mueller & Co., from whom they can now be obtained. They consist of a 20 cc. Record syringe (A), fitted with a threaded piston, a two inch connection of catheter rubber (B) with adapters, and a curved tracheal trocar and canula (C). The screw syringe is necessary because the oil, being relatively viscid, is with difficulty forced out by direct pressure. The catheter connecting piece permits movement of the canula on swallowing or coughing without movement of the syringe. The curved canula (Armand-Delille[5]) is used rather than a straight or curved needle (Sergent and Cottenot[4]) because it is less likely to injure the posterior tracheal wall and is better tolerated than a sharp instrument.

The technic of the procedure is as follows: One hour before the injection, to control the cough reflex, the patient is given from ½ to 1 grain of codein hypodermically. About three-quarters of an hour later he is told to lean over and rid himself of all accumulated sputum. He is then seated in a chair facing the operator, his neck painted with iodin, and with a fine hypodermic needle and 3 per cent novocain a dermal wheal is raised in the midline just above the cricoid. The infiltration is then carried to the level of the trachea, and with a slightly larger needle the trachea punctured and 4 to 5 cc. of the novocain solution injected. This usually causes coughing, and it may be necessary to draw out the needle and reinsert it two or three times before the whole amount is put in. While this is taking effect a tiny incision is made, just through the skin, with a narrow bladed knife, and the lipiodol, which has been sitting in a basin of warm water to bring it to the body temperature and decrease its viscidity, is poured into the syringe. Then, with the forefinger of the left hand acting as a guide on the cricoid, the trocar and canula are inserted through the skin

incision and into the trachea. The trocar is removed and, with an assistant steadying the canula, the syringe is fitted to it and the injection made. Before starting it the patient is told that coughing will spoil the result and is asked to do all in his power to prevent its occurrence.

The position of the patient during the injection is of the utmost importance. This determines the portion of the lung into which the lipiodol flows and consequently the success of the examination. With the patient upright, most of the oil will go into the left lower lobe. This cannot be counted upon, and in case one wishes to fill this the body should be inclined to the left at an angle of about 30 degrees. If it is desired to fill the right lower lobe the inclination should be to the right side. Both lower lobes can be filled by injecting part of the oil while the patient is leaning to the right, the remainder while he is leaning to the left. To fill the middle lobe the injection is made with the patient recumbent upon the affected side. Examination of an apex is the most difficult. In some instances one can be filled with the patient in the recumbent lateral position. It can be reached more certainly if immediately after the injection of the oil the patient is held over the edge of the table in the lateral position and with the head slightly lower than the hips.

The amount of oil injected is usually 20 cc. Forestier mentions having administered as much as 60 cc. at one time. What are the limits in this respect and what the greatest area of lung which can be safely examined at one time are points not yet determined. Not infrequently one is able to outline the bronchial tree of a complete lung with injection of no more than 20 to 30 cc. and without producing symptoms.

The X-rays must be taken immediately after the injection. While usually the patient does not start expelling the oil for from ten to fifteen minutes, there is always danger that he will cough, and consequently the sooner the pictures can be taken the less are the chances of failure from this source. It is our custom to take stereoscopic plates of the chest and then one oblique plate. This latter often throws into relief shadows which are otherwise obscured by the heart or diaphragm.

Since this article was submitted for publication our procedure has been considerably altered. In most instances it has been found unnecessary to inject the anesthetic into the trachea, and when it is necessary it has been found that 1 cc. of 2 per cent cocain solution is preferable to the novocain. In place of the trocar and cannula we now use merely a medium sized intravenous needle and a 20 cc. record syringe. Where these are used it is necessary to warm the oil well to decrease its viscidity and to verify the location of the needle by suction of air after the injection of each 2 cc. of oil. The larger the needle used the less difficulty is encountered in forcing in the oil.

REFERENCES.

1. Sicard, and Forestier, J.: Iodized Oil as Contrast Medium in Radioscopy. Bull. et mem. soc. méd. d. hôp. de Paris, 1922, 46, 463.
2. Pritchard, S., Whyte, B., and Gordon, J. K. M.: Use of Iodized Oil in Diagnosis and Treatment of Bronchial Affections. J. A. M. A., 1926, 86, 1119.
3. Rosenthal, G.: The Technique of Intercrico-Thyroid Injections. Paris méd., 1920, 10, 521.
4. Sergent, E., and Cottenot, P.: Cited by Armand-Delille.[5]
5. Armand-Delille, Duhamel et Marty: Iodized Oil in Roentgen Diagnosis of Bronchiectasis. Presse médical, 1924, 32, 421.

XVI.

COAGULATION TIME PRIOR TO TONSILLECTOMY.*

WESTLEY M. HUNT, M. D.,

NEW YORK.

There has developed during the last few years a tendency to do a routine coagulation time prior to all tonsillectomies. Some members of the laryngologic department of a large hospital were asked whether a routine coagulation time was done. The answer was, "Yes, it's a habit, but it is not considered necessary or advisable."

Similar opinions are common. One hospital does, the other does not. One laryngologist does, the other does not. One laboratory takes on the added work willingly; the other, of equal standing, feels that they are being asked to do a quite unnecessary amount of extra work.

Because of this difference of opinion, information was sought as to—

1. The value of coagulation time prior to tonsillectomy with reference to postoperative hemorrhage.
2. The legal value of coagulation time.
3. How many hospitals do a routine coagulation time.
4. What methods are used.

In the fall of 1925 a questionnaire was sent to 567 hospitals throughout the United States. This list included all special hospitals listed in the Red Book of Ear, Nose and Throat and 500 of the larger representative hospitals approved by the American College of Surgeons.

Replies were received from 300 institutions.

I. THE VALUE OF COAGULATION TIME PRIOR TO TONSILLECTOMY WITH REFERENCE TO POSTOPERATIVE HEMORRHAGE.

In 1922, Bailey[1] sent a questionnaire to 400 laryngologists, members of the American College of Surgeons, asking them

*Presented as a candidates' thesis to the American Laryngological, Rhinological and Otological Society.

whether they did a coagulation test before operation in any or all cases. The replies show that 75 used it, 60 never, and 215 sometimes used it. The general opinion seemed to be that while the test might be of value to the laboratory findings, a careful family history of the patient was much more important.

Coakley,[2] in 1922, remarks that there is an idea among many physicians that before removing tonsils in adults the coagulation time should be taken to ascertain whether it is prolonged. He further states that he has operated on many patients with a coagulation period more than double the standard, as ascertained by several laboratory methods, without finding any increase in hemorrhage, either at the time of operation or subsequently, with two exceptions, which might probably be accounted for by high blood pressure (160 or more).

He says in the absence of a history of hemophilia we assure our patients that the loss of blood during the operation is negligible, that postoperative bleeding is rare, and that it can and will be controlled before serious loss of blood occurs.

Miller,[3] in 1922, writing on "Control of Hemorrhage in Tonsillectomy," says cases for operation should always have coagulation time taken.

Rainey,[4] in 1923, reports that he has found the taking of coagulation time of the blood and the giving of calcium lactate to be of no special value in controlling postoperative hemorrhage.

Harter,[5] in 1924, speaks of the almost routine procedure of doing a coagulation time prior to tonsillectomy which has come into effect in the last five years.

He reports, from the Kings County Hospital, a study of 418 cases, which was undertaken to decide definitely whether there was any direct relation between prolonged coagulation time and hemorrhage, either at or after operation.

It appeared that prolonged coagulation time up to 15 minutes bears no relation to hemorrhage from tonsillectomy. One hundred fifteen cases had a period of 8 minutes or more, and twenty-one had 10 minutes or more. There was no special distribution as to age: sixteen had profuse bleeding, but fourteen of these had a coagulation time of 7 minutes or under; one had 8 minutes, and one 10.

He draws the conclusion that the only practical value of knowing the coagulation time is that if it is over seven minutes by the capillary tube method, a complete history should be obtained to rule out any general disease which might cause it, such as hemophilia, leukemia, purpura hemorrhagica, diseases of the liver, phosphorus and chloroform poisoning, yellow fever or miliary tuberculosis.

Dr. Carl H. Renter,[9] director of the laboratory of the Springfield City Hospital of Springfield, Ohio, adds a footnote in reply to his questionnaire that this hospital has done a routine coagulation time for eighteen months on all tonsillectomies. They have averaged about forty tonsillectomies per month for twenty years and have never had a fatal or even dangerous hemorrhage, as any bleeding is always stopped on the table. "When this is practical we question the worth whileness of routine coagulation determinations, as our cases showing the longer coagulation give no trouble. Our chief reason for doing routine coagulation is to counteract adverse criticism and be up with the times."

The Indianapolis City Hospital[9] writes that a routine coagulation time is not determined. It is done only in those with history of bleeding and that it is their opinion that it is not necessary. They have done approximately 140 tonsillectomies per month for six years, and have had no deaths due to hemorrhage, continuing to say, "That is adequate reason to eliminate such burdensome routine."

The Henry Ford Hospital, Detroit,[9] does not do a routine coagulation time except when there is a history of bleeding, family or otherwise, and have done 15,000 tonsillectomies to date, August 1, 1925, without a death from any cause.

The Rhode Island Hospital, Providence, R. I.,[9] reports that the coagulation test was made upon all ear, nose and throat surgical cases in 1918. After selecting 700 records of a period of two years the routine practice was abandoned. "We do not consider it desirable to do a routine examination of this kind, as the experience in results, so far as hemorrhage is concerned, is very disconcerting and quite contradictory. We have also found that in order to do proper tests its was necessary to obtain quite a large specimen from the veins."

Doctors Brein, Zeiler and Hammack, Los Angeles, Calif.,[9] pathologists to Good Samaritan Hospital, California Lutheran Hospital, Methodist Hospital and Angelus Hospital, Los Angeles, Calif., say: "No, we are clinical pathologists. We advise against it. Do not consider it of value." They suggest coagulation time in hemophilia and jaundice, "which can be diagnosed without a coagulation time."

Such institutions[9] as Johns Hopkins Hospital; Lakeside Hospital, Cleveland; Presbyterian Hospital, New York; Manhattan Eye, Ear and Throat Hospital, New York; Mount Sinai Hospital, New York; Knickerbocker Hospital, New York; Harlem Eye and Ear, New York; hospitals of the universities of California, Vanderbilt, Pennsylvania and Stamford do coagulation time only on selected cases, evidently showing the value and development of their history system.

The Worcester City Hospital, Worcester, Mass.,[9] says that routine coagulation time is not done except on selected cases, mostly tonsil cases in which anemia, history of bleeding, family traditions of hemophilia or other indications exist. Certain operators request it in adult cases but not in children. It is not considered desirable, as "methods are unsatisfactory. Retraction time is really the most valuable observation."

The Blodgett Memorial Hospital, Grand Rapids, Mich.,[9] does not do coagulation time except as ordered by surgeons. "Not desirable if staff nose and throat men are careful and conscientious."

Dr. A. A. Burke, chief of Eye, Ear, Nose and Throat Department, St. Vincent's Hospital, Norfolk, Va.,[9] says that some of the doctors have coagulation done routinely and others never.

His reason for discontinuing the test is because of the fact that he is convinced it is absolutely without any scientific aid. His opinion is that the control of hemorrhage depends but very little on the clotting time, and he thinks we have lost sight of the contractility of the tissues in the control of bleeding, which is borne out by the fact that we have more trouble with adults than we do with children.

The Jewish Hospital, Brooklyn,[9] does coagulation time only on all males, while the Harlem Hospital, Flint, Mich., does a

bleeding time also if coagulation time is markedly above normal.

The St. Anthony Hospital, Terre Haute, Ind.,[9] has done routine coagulation for two years and says, "We feel safer, in tonsil work especially."

The Battle Creek Sanitarium, Battle Creek, Mich.,[9] has done routine coagulation time for four years and says, "We think it desirable. An occasional case with delayed coagulation is observed and deferred until the coagulation is corrected."

At the Episcopal Eye, Ear and Throat Hospital, Washington,[9] routine coagulation time has been done for two years. To quote: "From psychologic viewpoint it is of benefit, if from no other. Most bleeders have shown short time coagulation period."

The Bridgeport Hospital, Bridgeport, Conn.[9] Routine for four years. "Without history from parents (not always possible) it is a desirable matter of record in event of trouble."

Post Graduate Hospital, New York.[9] Routine coagulation test not done but considered desirable. "Any additional safeguard is desirable."

The officers of the City Hospital of Akron, Ohio,[9] say their own experience during the past year has led them to question the value of routine coagulation time. At the present time their only claim to the surgeons in support of routine tests is that in cases having a long coagulation period every precaution should be taken and the patient very closely observed following operation. Their experience taught them that a long coagulation time does not mean that the patient will bleed unduly—in fact, the opposite has been true in a number of cases.

Dr. Dowling,[9] writing for the Memorial Hospital, Albany, says coagulation time is done only on selected cases, but he considers it "desirable because it adds to safety."

The St. John's Riverside Hospital, Yonkers, N. Y.,[9] reports that during the three years the routine coagulation test has been in force the percentage of those found where time exceeds the normal is negligible (less than one-half of 1 per cent). Yet they add, "We think it is advisable that a routine coagulation time be done."

An analysis by the writer of 2000 consecutive cases of tonsillectomies on children and adults done at St. Luke's Hospital* and Fifth Avenue Hospital, New York, showed the lowest coagulation time to be 45 seconds and the longest 15 minutes, an average of 5 minutes. In none of the cases was there any postoperative bleeding that could in any way appear to depend upon the length of the coagulation time.

An analysis by Miss Pratt[9] of the coagulation time by the capillary tube method in 1100 operations of all kinds at the Fifth Avenue Hospital, New York, is as follows:

Males, 529; females, 571. Eighty per cent were between 4 and 7 minutes. The largest number at any one time was 285, or 22 per cent, at 5 minutes: 113 males, 172 females. The shortest time, 1 minute; longest time, 10 minutes: 3 males, 1 female.

An analysis of twelve cases of posttonsillectomy hemorrhage, occurring from one to six days, postoperative. Males, 4.41 per cent; females, 7.58 per cent. Children, 7; adults, 5. Shortest time, 3 minutes, female adult; longest, 7 minutes, male child. No record, 4.

From this analysis it would appear that there is little relation if any between a coagulation time of 10 minutes or less by the capillary tube method and hemorrhage. While the number of posttonsillectomy hemorrhages analyzed is small—only 12—still the hemorrhages are appreciably less in the male, where we might expect to find true bleeders, than in the female.

Delay in coagulation time is observed in hemophilia, certain cases of pernicious anemia, splenic anemias and the leukemias.

To be reasonably sure of the control of postoperative hemorrhage by blood analysis it is not only necessary to consider the coagulation time but the bleeding time, blood platelet count and clot retraction.

Hemophilia is a hereditary disease, confined to the male sex but transmitted by the female alone. Bullock and Fields[6] have established the fact of immunity in the female.

1. Platelet count normal.
2. Coagulation time greatly prolonged, may be normal between times.

*From service of Dr. A. P. Voislawsky.

3. Clot when formed is firm and retracts well.

4. Bleeding time is usually normal, due to the normal amount of thromboplastic substances in the tissues.

Routine coagulation time would do much to avoid operating on a possible hemophilia.

True hemophiliacs are very rare.

Bleeding time is of no value.

There are no female hemophiliacs.

COMPARISON OF PLATELET COUNT, COAGULATION TIME, BLEEDING TIME AND CLOT RETRACTION.[7]

Diseases	Platelets	Coag. Time	Bleeding Time	Retract'n of Clot	
Jaundice	Normal	Prolong'd	Prolong'd	Prolong'd	
Henoch's purpura	"	"	"	"	
Anaphylactic shock	"	"	"	"	
Hemorrhage in newborn.	"	"	"	"	
Polycythemia vera	"	"	"	"	
Leukemias	"	"	"	"	
Lobar pneumonia	"	"	"	"	
Influenza	"	"	"	"	
Typhoid fever	"	"	"	"	
Chronic infections of sinuses and tonsils	"	"	"	"	
Idopathic purpura hemorrhagica	Below 200,000	Normal	Normal	Normal	If above 100,000 no sympt.
Aplastic anemia					
Lymphatic leukemias					
Pernicious anemias					
	Below 100,000 60,000-80,000	"	Prolonged	Poor	No sympt. necessarily
	Below 60,000	Normal	Much prolonged	"	Sympt'ms
	Below 30,000	Slightly prolonged	Indefinite	None	Sympt'ms

From the examination of the above chart, it will be seen that while in some instances the coagulation time will be of value, again the reactions are such in different stages of certain diseases as to render coagulation time alone at least of doubtful value if not wholly misleading.

II. THE LEGAL VALUE OF COAGULATION TIME.

The analysis of the reports of the 300 hospitals indicates that none of them has had any legal suit based upon whether or not a coagulation time was done prior to tonsillectomy.

The attorney[10] for the New York County Medical Society reports as follows: "While I cannot definitely tell, without an examination of my files, the number of instances in which the

claim failure to do a coagulation test was made the basis of a malpractice action or one of the specifications of negligence in such an action, I do recall several instances where the claim was made that the doctor in performing a tonsillectomy was careless or negligent, in that he had not previously done a coagulation test. In the instances where such a claim was made, the claim has been abandoned by the patient, the suit terminated in favor of the physician or is still pending trial, so that in no instance has a patient succeeded in establishing liability upon the part of a physician for failing to do a blood coagulation prior to a tonsillectomy."

The American Medical Association[11] has no records of instances in which damage suits have been brought because of failure to determine the blood coagulation time before performing a tonsillectomy.

III. NUMBER OF HOSPITALS DOING ROUTINE COAGULATION TIME.

An analysis of the 300 replies indicates that 176 do a routine test, 59 do no coagulation time, while 65 do a coagulation time only when ordered by the physician in charge.

It was also ascertained that in those institutions which had a standing order, this standing order had been in force for quite different lengths of time over a period of ten years only.

The following chart illustrates the status of blood coagulation tests in the 300 hospitals:

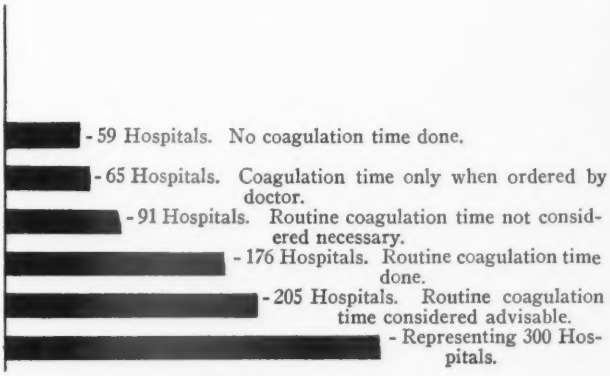

- 59 Hospitals. No coagulation time done.
- 65 Hospitals. Coagulation time only when ordered by doctor.
- 91 Hospitals. Routine coagulation time not considered necessary.
- 176 Hospitals. Routine coagulation time done.
- 205 Hospitals. Routine coagulation time considered advisable.
- Representing 300 Hospitals.

CHART 1.

An analysis of the 176 hospitals doing a routine coagulation time with reference to the number of years such a standing order has been in force (1916-1925):

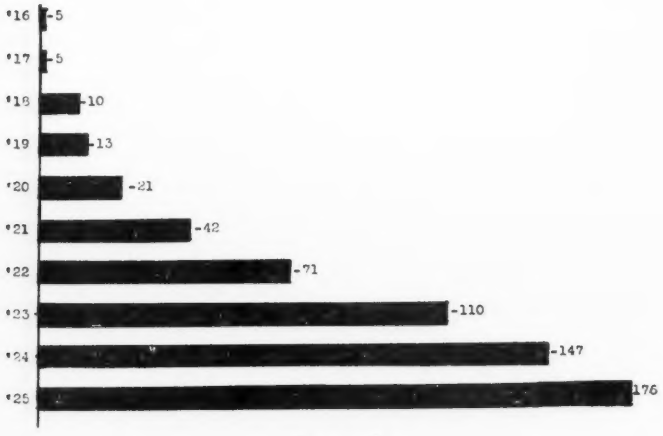


CHART 2.

IV. METHODS IN USE.

One hundred eighty-five hospitals designated their method of doing coagulation time as follows:

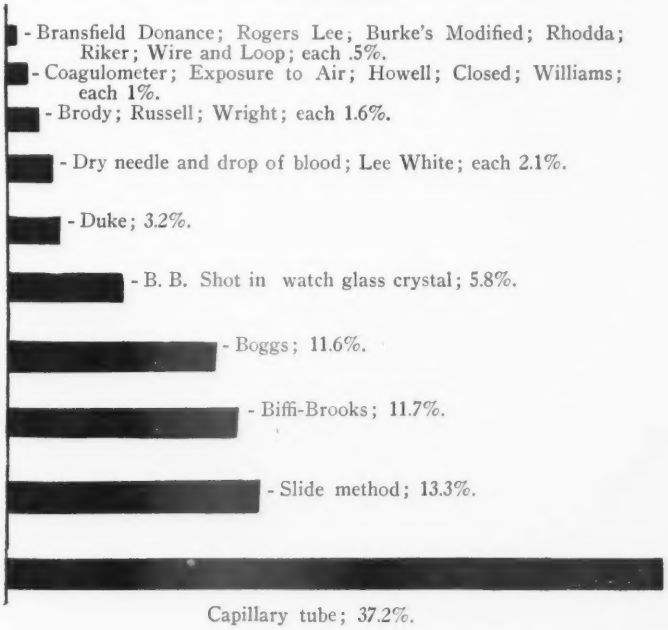

- Bransfield Donance; Rogers Lee; Burke's Modified; Rhodda; Riker; Wire and Loop; each .5%.
- Coagulometer; Exposure to Air; Howell; Closed; Williams; each 1%.
- Brody; Russell; Wright; each 1.6%.
- Dry needle and drop of blood; Lee White; each 2.1%.
- Duke; 3.2%.
- B. B. Shot in watch glass crystal; 5.8%.
- Boggs; 11.6%.
- Biffi-Brooks; 11.7%.
- Slide method; 13.3%.
Capillary tube; 37.2%.

CHART 3.

These are a few of the most explicit answers and are quoted only to show that there is really a very great difference in opinion over the country as to the advisability of a routine coagulation time prior to tonsillectomy.

It is undoubtedly the lot of the nose and throat surgeons to be quickly and severely criticised if a death or serious hemorrhage occurs following a tonsillectomy, for the following reasons:

1. The rarity of such mishaps, considering the number of operations done.
2. The tendency of the laity to regard a tonsillectomy as a minor operation.
3. The usual nonemergency status of the tonsil operation.
4. The unpreparedness of the patient's friends for fatal or near fatal results, in contrast to general surgery.

It is reasonable to suppose that in those institutions where a routine coagulation time is not done, the element of risk has not been overlooked, that they have arrived at a method of recording histories and physicals in a manner which eliminates this danger and that those institutions which do a routine coagulation time prior to tonsillectomy are not so organized or are desirous of adding this additional protection.

No institution should allow a tonsillectomy to be done without a reasonable recorded knowledge of the patient's blood history. If this safeguard is more easily obtained by routine coagulation it should be done. However, it must be admitted that as outpatient departments are developed and cooperation between departments is increased it might be possible to eliminate this extra work with safety.

The private patient belongs in a class by himself. If a coagulation time is done, either for psychologic effect or for a definite end, there is usually some financial remuneration which takes the sting from the hospital and laboratory routine.

CONCLUSIONS.

1. There is considerable interest in routine coagulation time prior to tonsillectomy.
2. Sixty-eight per cent of the 300 hospitals sending replies consider a routine coagulation time advisable.

3. Fifty-eight per cent, a little over half, do a routine coagulation time.

4. This 58 per cent class has come into existence in the past ten years.

5. The most popular method by far is the capillary method.

6. In spite of the increase in the taking of routine coagulation time, little is to be learned from such a test as to post-operative hemorrhage.

7. There is apparently no great legal risk for those who do not follow this practice.

8. Hemophilia occurs only in males and is rare.

9. A coagulation time is not always indicative of bleeding time, and vice versa.

10. Routine coagulation time is desirable to make a full and complete record of the patient while in the hospital, but

11. It is not necessary for the welfare of the patient if a proper history has been taken.

12. A coagulation time should be done on all staff cases unless

(a) All children admitted for adenoidectomy and tonsillectomy are sent through the children's department for complete history and physicals in consultation with parents prior to recommendation for tonsillectomy.

(b) All adults have thorough history and physicals in both outpatient department and hospital.

13. All doubtful cases should have both coagulation and bleeding time done.

14. Private cases can well be left to the discretion of the attending surgeon.

15. The only apparent advantage of a routine coagulation time prior to tonsillectomy in an institution which has facilities for a thorough history and physical record is for that added margin of safety "when trouble comes."

33 East 68th Street.

BIBLIOGRAPHY.

Howell, W. H.: Am. Journal Physiol., 1912, XXXI, 1.
Brodie, T. C., and Russell, A. E.: Journal Physiol., 1897, XXXI, 269.
Rodda, F. C.: Am. Journal Dis. Child., 1920, XIX, 269.
Duke, W. W.: Journal Am. Med. Asso., 1910, IV, 1185.
Duke, W. W.: Arch. Int. Med., 1912, X, 445.

Dock, Geog.: Methods in Medicine.
Mallory and Wright: Eighth edition.
Osler and McCrae.
Beinfeld, H. H.: Med. J. and Red., 120, 11, July 2, 1924 (Supp.).

REFERENCES.

1. Bailey, F. W.: Iowa State Med. Soc., 12, 222, June, 1922.
2. Coakley, C. G.: J. Laryngol. and Otol., Edinburgh, 37, 3, Jan., 1922.
3. Miller, C. M.: Virginia Med. Monthly, 49, 391, Oct., 1922.
4. Rainey, John J.: Laryngoscope, 33, 446, July, 1923.
5. Harter, J. H.: Northwest Med., 23, 516, Nov., 1924.
6. Bullock and Fields: Dulan & Co., London, 1911.
7. Stitt, E. R.: Pract. Bact., etc.
9. Personal communication.
10. Personal communication. Mr. George W. Whiteside, Sept. 17, 1925.
11. Personal communication. A. M. A., Sept. 14, 1925.

XVII.

THE ANATOMIC, PATHOLOGIC AND CLINICAL RELATIONSHIP OF THE POSTERIOR SINUSES TO OPTIC NEURITIS.

By Claude G. Crane, M. D.,

Brooklyn.

When one considers the anatomy of the posterior ethmoid cells and the sphenoid sinuses, in their relationship to the optic nerve canal, it is very evident that posterior sinus infection and optic neuritis constitute a clinical entity that will be recognized with increasing frequency due to the world wide attention directed to this subject during the last few years.

The bony partition separating the posterior ethmoid cell and the sphenoid sinus from the optic canal is, in most instances, very thin, and in a considerable percentage there exists a dehiscence in the bony partition in one or more areas, allowing the optic nerve and mucous membrane lining of the posterior cell or the sphenoid sinus to lie in immediate contact, separated only by a single layer of periosteum. It is well to note that the periosteum of the canal is inseparable from the sheath of the optic nerve. When the bony partition is intact, the relationship is so intimate that there is every reason why posterior sinus infection should cause optic neuritis. Posterior sinus disease is so common that few people have escaped it in one form or another. Optic nerve involvement is comparatively rare. There must be some reason why the optic nerve escapes invasion except in a very small percentage of the cases.

It is the posterior ethmoid cell, situated at the posterior external angle of the ethmoid capsule, that is responsible for the greater number of attacks of neuritis. This area is, I believe, more frequently the active factor than the sphenoid sinus. Infection in this area becomes very readily walled off from the usual nasal drainage, and thus invasion of the optic canal is rendered more likely. The opening of the sphenoid sinus, while inadequate for proper drainage, usually remains suf-

ficiently open to afford some relief. Very often several cells in the posterior external angle will be found to encroach upon the optic canal, not only making the canal smaller, but also oval or angular in shape rather than round.

The intimate circulation in this area readily explains the ease with which direct invasion may occur. The ophthalmic artery and vein and their branches supply and drain the sinuses and the orbit. The nervehead is supplied and drained by a network of arteries and veins which forms an integral part of the sinus circulation. The intracanalicular section of the nerve is supplied by small muscular branches of the ophthalmic artery and is drained by the vein of Vossius, which in turn drains into the cavernous sinus. Numerous veins from the periosteum of the posterior orbit and the periosteum of the posterior ethmoid cells and sphenoid sinus flow into the vein of Vossius. The lymphatic circulation between the posterior sinuses and the posterior orbital structures forms a network of communication.

The direct extension of infection is certainly invited by this intimate relationship. Any inflammation sufficient to cause hyperemia without actual extension of infection may be sufficient to cause pressure within the optic canal and consequent nerve changes. When the nerve tissue is involved the results are more serious. A study of the anatomy of this area supports the theory that pressure within the canal is the immediate cause of the changes in the nerve. On the other hand, it is equally manifest that a toxic invasion of the nerve is invited by the close association of the circulation, and that the changes in the nerve may be purely toxic in character. Weight is added to this theory from the fact that the central papillomacular fibers are always primarily involved. It is an established fact that these fibers are the most sensitive of the nerve bundles in the nerve. We must admit, however, that pressure on the nerve would naturally affect these same fibers primarily, which renders it difficult to accept either theory to the exclusion of the other. I believe that both of these theories are tenable. In any given case pressure may be the predominant factor, and in another toxic invasion may be the real lesion. I can see every reason why it is possible to have both pressure and toxemia present at the same time. In the cases that are

primarily toxic, pressure must of necessity be a factor just as soon as swelling of the contents of the bony canal develops.

Anatomic studies demonstrate numerous instances in which the cells of the posterior superior angle crowd the inner and superior wall of the optic canal. Given an optic nerve which varies scarcely at all in size, it is evident that the size of the optic canal has a very important bearing on the degree of pressure to which the nerve is subjected in any given case. White, in his very exhaustive studies of skulls and in his unusually accurate observations on a large group of cases, has called our attention to the need of considering the size of the canal in determining the prognosis in any given case. In Piersol's anatomy the diameter of the optic nerve is stated to be from 3 to 4 mm. While some anatomists give the optic canal a diameter of from 5 to 7 mm., White, in his examination of 164 adult skulls, found the average diameter to be 5.17 mm. The 5.5 mm. and the 6 mm. canals were all round, and only two had extensive pneumatization about them. Several of the canals were 5 mm. and were slightly oval. Of the 4.5 mm. canals, some were flattened at the top, and practically all were partly surrounded by pneumatized sinuses. It is probable that we have here the explanation of the vulnerability of the optic nerve in a considerable group of cases.

Given an abnormally small canal, which is practically always oval or triangular, due to the crowding of abnormal cells, it is evident that excessive pressure will be exerted immediately the canal is involved and permanent damage to the nerve result, unless relief of the pressure is quickly brought about by adequate surgical measures. White calls attention to the very interesting fact that the size of the optic canal in infants and children is practically that of the adult, although somewhat shorter.

In 1908, Onodi described the anatomic relationship between the optic canal and the posterior ethmoid cells and the sphenoid sinus. He described the bony partition as of tissue paper thinness and pointed out the frequency of the entire absence of bone, thus allowing contact of the soft tissue structures. He also demonstrated that frequently the posterior ethmoid cell was in close relationship to the optic canal, when the sphenoid sinus was rather remotely situated. It is interesting to note

that previous to 1908, Onodi had devoted ten years to the anatomic study of the relation of the optic canal to the ethmoid sphenoid area. He had at this time established to his own satisfaction the anatomic foundation for the theory of sight disturbances and blindness, caused by disease of the accessory sinuses, particularly of the posterior ethmoid cells and the sphenoid sinus. He had not, at this time, however, done more than establish the basis for the pathologic anatomic theory of the etiologic relation of optic neuritis to posterior sinus disease. He believed that his own clinical observations corroborated the pathologic anatomic studies, but considered further studies and observations necessary to absolutely prove the relationship. Onodi had advanced a great way seventeen years ago. It is not to our credit that considerable time elapsed before we were prepared to accept the deductions of Onodi, so convincingly and ably presented. Onodi gives due credit to Berger and Tyemann for first describing in detail the anatomy of this area in their monograph published in 1886.

A thorough study of the literature on this subject again emphasizes what we so frequently experience in a historic review of almost any medical subject, that real advances are made so slowly that we often lose sight of the source from which they emanated.

To further quote Onodi, he proved to his own satisfaction, from his studies, that a one sided contralateral or double sided involvement of the optic nerve is possible, even though only the cells on one side are diseased. He went so far as to state at this time that, given optic nerve involvement and no positive cause established, the sinuses should be explored, even though no pathology is demonstrable. This is in conformity with our present attitude.

In 1909, Loeb published his findings on the anatomic relations of the optic nerve to the accessory sinuses. Up to that time a considerable number of cases of optic nerve blindness, due to sinus disease, had been reported, but the diagnosis was made on the clinical evidence and not on a proven pathologic relationship. Loeb sectioned fifteen heads and demonstrated very closely the variable relationship between the nerve and the sinuses. Loeb found a great variation in the size, shape

and position of the sphenoid sinus. Again, in 1914, Loeb, in his book on "Operative Surgery of the Nose, Throat and Ear," described very minutely the anatomic relation of the optic nerve to the sphenoid sinus and the posterior ethmoid cell. He stated that the unusual position, as demonstrated in many specimens, was largely responsible for the excessive vulnerability of the optic nerve to disease of this area, whenever this intimate relationship exists in any given case of posterior sinus infection.

Young found that dissection of thirty sphenoid sinuses revealed four with one or more dehiscences in the bony wall separating the optic nerve and one with practically no bony wall present.

Onodi was undoubtedly the first to point out the close relationship of the posterior ethmoid cell to the nerve. The posterior ethmoid cell may replace the sphenoid sinus in relation and in position and assume the etiologic position. Previous to this the sphenoid sinus was believed to be the causative factor in practically all of the cases. While the outer wall of the sphenoid sinus may envelop the optic nerve, the sinus may also be well walled off from the nerve. The posterior ethmoid cell may be present itself as a large single cell, practically taking the place of the sphenoid, or there may be two or three cells occupying the area of the posterior superior angle of the ethmoid capsule. The optic nerve passes externally from the chiasm along the roof or lateral wall of the sphenoid sinus and along the external wall of the posterior ethmoid cell. Rarely does the nerve pass less intimately, but frequently the relationship is much more intimate, as seen in those instances where dehiscences exist in the wall of the sphenoid or ethmoid cell, or where there are excess cells partly surrounding the nerve in the canalicular portion. When the posterior ethmoid cell replaces the sphenoid, the nerve lies along its outer wall for the greater part of its length. When the sphenoid orifice is nearer the optic nerve and when the posterior cell replaces the sphenoid, the likelihood of nerve involvement is increased.

Schaeffer states it is essential that the intimate anatomic relationship which exists between the sinuses and the optic nerve be understood by ophthalmologists and rhinologists. In

his book, published in 1920, he considered it important to emphasize this point and the need of recognizing a pathology that may lead to complete loss of vision. Schaeffer's anatomic studies conform in practically every particular with those previously reported by Onodi and Loeb.

In 1923, Westlake continued the anatomic studies of Loeb, and in his tabulated series of seven heads, carefully sectioned and studied, pointed out the remarkable agreement of his findings with those of Loeb.

While it is true that numerous cases of optic nerve blindness, due to sinus disease, have been reported, it is only within the last few years that the recognition of this very serious condition has been a matter of everyday experience.

In 1886, Berger and Tyemann collected twenty-six cases of blindness that had been reported as due to sphenoid disease, twenty of which were due to tumors.

In 1892, Caldwell reported a case of double optic nerve atrophy due to suppuration of the ethmoid sphenoid area.

In 1895, Krause reported three cases of optic neuritis secondary to sphenoid disease.

In 1896, Holmes reported a case of complete blindness of one eye, cured by opening an infected sphenoid sinus.

Hansell, in 1896, reported a case of acute blindness, due to ethmoid and sphenoid disease.

In 1898, St. Clair Thomson reported a case of optic neuritis, due to sphenoid infection.

De Lapersonne, in 1899, reported several cases of unilateral optic neuritis which terminated in complete blindness. Rhinoscopic examination revealed infection of the posterior ethmoid cells and sphenoid. De Lapersonne's observations were confirmed by a number of competent men, but as yet they were not prepared to recognize the true etiology to the extent of advising operative measures on the sinuses.

In 1901, Halstead reported a case of blindness in the left eye, cured by operation on the sinuses.

Wendel, in 1901, reported several cases benefited by operation.

Again in 1902, De Lapersonne discussed the subject at length and quoted Rheinhardt, Braun, Neiden and Panas as having observed optic neuritis with sinus infection. He con-

sidered it possible at this time to ameliorate the condition by treatment, but considered the prognosis as practically hopeless. He stated at this time, however, that he believed that lesions of the sphenoid and ethmoid sinuses could, by a process of contiguity, cause pathologic changes in the optic nerve.

Risley, in 1904, reported a case of three years' duration, in which the impaired vision was restored by operation on the sinuses.

Moritz, in 1905, stated that optic neuritis, with sudden loss of vision, could result from compression of the nerve at the foramen or from perineuritis.

Alexander, in 1905, reported a case of bilateral optic neuritis resulting from infection of the sphenoid and posterior ethmoid cells.

Packard, in 1907, reported several cases of optic neuritis, due to sinus disease.

In 1907, Posey observed that there were numerous cases of retrobulbar optic neuritis, seen in the earlier years, accompanied by influenza and colds in the head, which were unrecognized. These cases received general treatment, with resultant loss of sight in many instances, whereas proper attention would have restored the vision in a few days.

In 1907, in the Laryngoscope, Sluder reported a case of optic nerve blindness due to involvement of the posterior ethmoid only, in which complete recovery ensued, following conservative measures directed to the purulent ethmoiditis.

In reviewing the early cases reported and the attitude of competent observers, it is interesting to note that Onodi found little support from ophthalmologists for his deductions based on his anatomic pathologic studies. Some of the leading ophthalmologists abroad were unwilling to accept optic nerve blindness due to sinus disease as a clinical entity. He communicated with a number of ophthalmologists with the idea of obtaining clinical proof of the deductions he had made.

Schmidt-Rimpler said there was no real proof that empyema of the sphenoid sinus could cause optic neuritis. Axenfeld had seen one case of neuritis with sphenoid disease, and concluded that it was a very rare condition. Sattler did not consider that unilateral optic neuritis indicated ethmoid or sphe-

noid disease. Other ophthalmologists, however, had from time to time seen and recognized a considerable number of cases.

During this same period this subject was discussed in the current literature by a considerable number other than those already quoted—Green, Glegg, Hay, Paunz, Schmiegelow and a few others.

H. Knapp, however, in 1906, expressed his unbelief by stating that he had never seen optic neuritis in connection with sinus disease except in those cases in which the orbital contents were invaded.

Following these early cases there was a period during which few cases were reported in the literature.

In 1919, White reported seventeen cases from his own practice, which was by far the largest number that had been reported by one writer. Up to 1924, White had reported twenty-three additional cases, covering a period of about five years. White had been unusually active in the study of these cases, and it is interesting to note that even so he has not seen on an average of more than five cases a year for a period of five years. White stated in 1919 that these cases are so rare that we seldom see enough of them to know what to expect.

Since that time we have moved very fast, and our knowledge of these cases is now organized, and the diagnosis and treatment are very definitely determined.

In 1922, Van der Hoeve discussed this subject at length and stated that no one is exempt from attacks of inflammation of the nose, and in every instance the sinuses are more or less involved. Considering how close a relationship we have between the posterior sinuses and the optic nerve, it is surprising that the optic nerve escapes as often as it actually does.

Within the last few years rhinogenous retrobulbar neuritis has received acute attention in almost every country where scientific medicine is practiced.

Kossig, in 1922, reported six cases and attempted to clear up some questions still under dispute. This author states that the pathologic changes in the nose vary from a slight serous catarrh to a severe purulent inflammation associated with mechanical obstruction to the discharge of the secretion. From the ophthalmologic point of view, five of the six cases appeared as a pure, uncomplicated retrobulbar neuritis. The anatomic

relations between the alterations in the nose and those of the optic nerve are apparently by an extension of inflammatory foci in the accessory sinuses to the sheath of the optic nerve, which in the optic foramen also forms the periosteal lining of the osseous canal. Edematous infiltration of the tissues in that locality exerts pressure upon the nerve and particularly injures the most sensitive fibers of the maculopapillary bundle.

An etiologic connection between any particular operative interference in the nose and consequent improvement in the function of the eye, is indicated by the fact that, as a rule, improvement results on the day following the operation. A still more convincing proof is the diminution of visual power as soon as the catarrhal symptoms of the nasal cavity grow worse. In some cases the mere readmission of air to the upper nasal cavities seems to be sufficient to secure success. Sometimes operative measures on the healthy side of the nose result in improvement of symptoms, a fact which is explained by the author on the ground of certain anatomic conditions—that is, at times the right sphenoid sinus reaches far across the median line to the left side, the partition remains nearly vertical, and the picture is that of a double sphenoid sinus on the left, resembling that of a superimposed ethmoid cell. In reality, the upper cell corresponds to the right and the lower to the left sphenoid sinus. The author advises removal of the middle turbinate and the free edge of the upper turbinate, thus opening up the sphenoid ethmoid recess and giving the best possible chance of reaching the bone cells surrounding the optic canal. From this point it is possible to judge whether an ethmoid cell is involved, in case a displacement exists. Having observed no untoward effect of the operation in any of his cases, the author holds that an exploratory nasal operation is justified in doubtful cases. I have quoted Kossig at length, because he expresses so completely the viewpoint as expressed by most writers in 1922.

It will be illuminating to quote a number of other writers on this subject.

Gordon, in 1924, stated that optic nerve manifestations secondary to sinus disease are many and varied, and are so like those produced by numerous other causes, that, at times, the most painstaking effort of the ophthalmologist, the internist

and the rhinologist are called into play to determine the cause, and even then, definite conclusions are sometimes wanting. It is the contention of many that pressure is the main factor in the production of a retrobulbar neuritis; others believe it to be due to edema of the optic canal, with resulting venous stasis; still others hold that a direct transmission of toxins into the canal around the vein of Vossius and the capillaries supplying the central bundle is the cause. Hyperplasia with infection has been advanced as a cause by some authors. This author further observes that optic nerve involvement may be insidious or gradual, or it may be sudden in onset, with partial or complete blindness. There may be enlargement of the blind spot, central scotoma, contraction of the visual field, pupillary changes, diplopia, paresis, neuritis, papilledema, choked disc and atrophy.

St. Clair Thomson, in 1923, reported the following cases:

A young man of twenty-four developed retrobulbar neuritis of the left eye, of rapid onset, due to suppuration in the sphenoid sinus. X-ray examination revealed obscurity of the frontal and sphenoid sinuses. Ophthalmic examination showed marked swelling of the left optic disc, blurring of its margins and obscuration of the retinal vessels. The patient was given local conservative treatment for three days with no improvement, when operation on the sphenoid sinuses was performed. On the fourth day following operation the patient noticed an improvement in his vision. Progress was continuous, resulting in a cure in two and one-half months. The swelling of the disc subsided, but ill defined margins were still present. The retina was clear.

Thomson stated at this time that while the nose is frequently the source of orbital infections, retinitis, papillitis and optic atrophy are only rarely caused by sepsis of the accessory sinuses. In certain cases of retrobulbar neuritis in which the sphenoid sinuses were opened, the sinuses were found free from suppuration. The exploratory opening of the sphenoid sinuses without evidence of suppuration in retrobulbar neuritis seems to be warranted from recorded cases, when no other cause can be found and the patient is threatened with blindness. Some patients recover without operation on the sinuses and without any definite diagnosis of the cause.

Wolfe, in 1923, observed that there is much disagreement as to the exact cause of retrobulbar optic neuritis. He considers sinus disease the most frequent cause of involvement of the maculopapillary bundle.

Demaria and Layera, Barcelona, in 1923, discussed this subject most thoroughly and observed that infections of the ethmoid cells or sphenoid sinus may produce optic neuritis in one or both eyes, as well as other grave ocular complications. Optic neuritis so produced may range all the way from simple hyperemia to optic atrophy. Modern improvement in technic has shown that sinus infections may also produce more obscure changes in the optic nerve, such as retrobulbar neuritis, in which enlargement of the optic papilla occurs. Perception for red, blue and, in late stages, for white, may become diminished until an absolute scotoma is formed. In diagnosis, sinusitis must be distinguished from intoxications from alcohol, tobacco, etc., multiple sclerosis, syphilis and tuberculosis. The posterior ethmoid vessels are in close relation with those of the orbit and often transmit infection. The optic nerve is especially vulnerable on account of its functional activity, fine fibers, thin sheath of myelin and circulatory relations. They quote Van der Hoeve to the effect that retrobulbar neuritis is supposedly due to sinusitis if the scotoma is greater for colors than for white, if the blind spot is abnormally large for both white and colors, and if the scotoma varies during the infectious process. They do not, however, consider the sign pathognomonic.

Goris, Lyon, in 1923, reported two cases in addition to two previously reported. This author is in accord with Sargnon, who holds that it is sufficient to resect the middle turbinate, to expose the ethmoid and reach the sphenoid sinus, as in most cases there is no visible lesion. In the frank suppurative cases he operates very radically.

Valude and Chantier, Paris, in 1923, added another case. Following conservative measures without relief, the sphenoid was opened with improvement in vision the next day. The sphenoid in this case appeared normal.

Davis, London, in 1923, reported on the examination of fifty-four cases of retrobulbar neuritis in which only four showed nasal sinus suppuration. These four were operated

upon. Three resulted in dramatic improvement in vision, and the fourth showed no betterment, due to atrophy. These were frank suppurative cases, but the author advises operation in any case of progressive blindness, even though no sinus lesion is manifest.

Van den Wildenberg, Paris, in 1923, made some very pertinent assertions. Nothing could be more deceptive than placing reliance upon the few reports of spontaneous cure, and nothing could be more dangerous than postponing energetic therapeutic measures to combat this affection, which so often ends in total loss of vision. The spontaneous cures do not exclude the sinus origin of this form of neuritis. Another error, the writer believes, is to abstain from surgical intervention in a patient coming late for treatment. Numerous observations have shown that operation can arrest the progress of the neuritis and can sometimes reestablish the lost function of the nerve.

Falk, in 1923, reported two cases. The acute case had a prompt return of vision, and the subacute case showed a more gradual improvement. In both cases the operation revealed no gross evidence of disease.

Williams, in 1923, reported a very unusual case, which is well worth recording. This patient had attacks of blindness in one or both eyes which would last for a few minutes and then clear up. The outstanding features of the case were the relatively negative ophthalmic findings, the negative campimetric findings, the varying sizes of the visual fields for form, and the diversity of opinions of rhinologists and ophthalmologists. This case was observed over a period of eight years and cleared up eight weeks after radical nasal surgery, which revealed infection in both sphenoid sinuses.

Husik, in 1922, reported a case in a child seven years old. Following a severe cold in the head, total blindness in both eyes developed. The nasal examination revealed only congested middle turbinates. The ethmoid cells and sphenoid sinuses of both sides were opened and the tonsils and adenoids removed. Operation failed to reveal pus in any of the sinuses. Complete restoration of vision followed the operative procedure.

Portmann and Pesme, Bordeaux, in 1924, reported two cases and offered the following observations:

When objective signs, even imperfect, suggest the existence of a posterior sinusitis, the operative indication becomes evident, and there is justification for expecting an improvement in the retrobulbar optic neuritis following intervention. However, it would be much more satisfactory to be able to verify and establish in the clinical appearance of the neuritis special characteristics by which the sinus origin of the condition could be recognized ophthalmoscopically. The presence of such characteristics in doubtful cases in which the rhinologist is not able to establish a diagnosis of posterior sinusitis, would constitute an operative indication of great value.

For some months the ophthalmoscopic examinations of one of the authors has revealed an abnormal symptomatology differing from the classical descriptions, and the existence of sinus lesions has been confirmed by intervention and pathologic examinations. It would seem, from their observations, that if, with a central scotoma, indicating retrobulbar neuritis, there is also found, contrary to what might be expected, an inflammation of the optic disc, a papillitis, it suggests a lesion of the optic nerve due to infection of the posterior sinuses. The existence of this syndrome would be an acquisition of great importance if confirmed by other observers.

I have purposely quoted the above remarks to draw attention to the effort being made to establish a characteristic ophthalmoscopic picture of these cases. So far we have failed to establish a reliable and consistent diagnostic ophthalmoscopic picture.

Bouget, Lyon, in 1924, took issue with the previously published reports of cases of retrobulbar neuritis cured by opening the sphenoid and ethmoid sinuses, even though no pathologic condition in the sinuses could be demonstrated. He emphasizes the fact that it is rare to observe similar ocular manifestations when these endonasal cavities show definite signs of infection. He quotes Hajek to the effect that in spite of a wide experience, he has never observed ocular disturbance of this kind in his numerous cases of sinusitis. The author concludes, from a number of examples and from published statistics, that the opening of the healthy posterior sinuses, and they must be considered healthy when there are no objective rhinoscopic

signs, and operative intervention and radiography reveal no lesion, cannot bring about the cure of retrobulbar neuritis, which it is known tends to spontaneous cure without surgical aid; neither has it any beneficial effect on the slowly progressive cases, though in chronic cases it is exceptional to observe papillary atrophy with complete blindness. The partisans of the operation insist upon early operation to obtain good results; that is, within the first two weeks, but it is important to remember that it is exactly within this time that spontaneous recovery begins. Independent of the facts which go to prove that curettage of the ethmoid and opening of the anterior wall of the sphenoid have no influence on the cure of acute or chronic retrobulbar neuritis, however, there is perhaps another reason, theoretical though it is, to explain the occurrence of retrobulbar neuritis, namely, the narrowing of the optic canal through which the nerve passes. If, in fact, one can suppose an osteoperiostitis of this canal, no matter from what cause, there would result compression of all the nerve bundles comprising the optic nerve, and those which would be subjected to the greatest pressure would be exactly these central macular fibers. If the osteoperiostitis is cured, the retrobulbar neuritis is cured. If this hypothesis is admitted for chronic retrobulbar neuritis, it is hardly possible to conceive that simple opening of the ethmoid or sphenoid would lead to decompression of the nerve.

Here, again, I have quoted this author in considerable detail, owing to the discordant note his observations have injected into an unusually harmonious discussion of this subject in the literature. This entity has been accepted by such a large group of competent observers that it is surprising to find an author, as late as April, 1924, taking decided issue with what we have for some time considered as proven beyond reasonable doubt.

De Stella, Paris, in 1924, reported fifteen cases and considered the advisability of treating conservatively those cases in which no pathology of the posterior sinuses could be demonstrated, but advising radical procedures in those cases in which any pathology whatever could be detected.

Vinsonneau, Paris, in 1924, wrote that, from his own experiences and those of numerous other observers, the pathologic relationship of the sphenoid sinus and posterior nasal

fossa to retrobulbar neuritis is a matter of daily observation. He urged the need for the ophthalmologist to search for a nasal etiology in explanation of numerous cases of ocular pathology.

White, in 1924, reported on forty-two cases that had been studied up to that time. Of this number eleven were not operated upon. In some cases there was complete optic atrophy when first seen, and operation was not indicated. In others, the loss of vision was very slight and recovery commenced so soon after local treatment, that operative procedures were unnecessary. In two or three, operation was suggested, but refused. One case, referred with the X-ray diagnosis of pansinusitis with optic neuritis, proved to be one of multiple sclerosis. Thirty-two operations were performed. Normal vision was obtained in thirteen, marked improvement in ten, slight improvement in six, and practically no improvement in three. In the three cases without improvement, permanent changes had taken place in the time since the onset of the neuritis. Of the six cases in which there was slight improvement, the duration in the first was two months; in the second, four months; in the third, one month; in the fourth, two years; in the fifth, nine months, and in the sixth, eleven days. In some of the cases in which normal vision was obtained it was thought that probably good sight might have resulted if the patients had not been operated upon. The author suggests treating the cases longer and studying them more thoroughly before operating.

A. Logan Turner, in 1924, considered that the description of what is found with the ophthalmoscope and by means of the visual tests, in cases of visual disturbance reported as due to sinus mischief, varies so much that it is difficult for the ophthalmologist to possess accurate conception of the ocular disturbances and findings in this group of cases. Further, he states, the laryngologist is not always in a position to say whether, after careful examination, the posterior sinuses are diseased or healthy. Recently, attention has been drawn to the existence of latent sinus disease, especially in the posterior cavities, in which subjective nasal symptoms are entirely absent at times. Careful examination will show a slight departure from the normal, such as a little increase in moisture, a somewhat greater congestion of the mucosa on one side, a little

edema of the middle turbinate, with gluing of its medial surface to the opposing septum. The question arises whether such change is to be taken in every instance as evidence of posterior sinus catarrhal mischief, necessitating drainage, or whether it is evidence of a catarrhal condition in the nasal cavity itself, subjecting the posterior sinuses to imperfect aeration with serious consequences to the eye. It suggests that nasal treatment alone might sometimes suffice to cure the eye condition. In some apparently normal nasal cases, the eye condition improves or is cured after operation on the sinuses, in which case the true etiology of the eye condition must probably be sought elsewhere.

Turner's remarks are very pertinent, and suggest the very great need of a careful study of these cases from every angle —ophthalmologic, rhinologic, neurologic and medical—before drawing conclusions as to etiology, pathology and treatment. It must be emphasized, however, that the delay which this may entail may seriously affect the prognosis.

Syme, in July, 1924, pointed out the vulnerable position of the optic nerve in any case of disease of the posterior sinuses. Syme does not believe that toxemia from a remote focus satisfactorily explains the frequency of optic neuritis in sphenoid disease. He agrees with the proposition that direct extension of the infection is the most likely explanation.

Young, in 1924, stated that no one can say that an infection, producing little or no change in the macroscopic appearance of the sinus mucosa, may not cause a neuritis in the more delicate and less resistant structure of the optic nerve.

Traquair, Edinburgh, in 1924, wrote that it cannot be doubted that rare cases of optic nerve disease occur, in which the evidence of nasal sinus disease is very slight or absent until operation discloses the presence of pathologic conditions. He feels that the present problem is the building up of a clinical picture of rhinologic retrobulbar neuritis sufficiently characteristic to be pathognomonic.

Dundas Grant, in 1924, reported several cases. One case of bilateral neuritis of almost a year in duration cleared up following operation. Other cases of five months, six months and two years in duration obtained a return of vision following

operation. Cases of this type should encourage us not to give a hopeless prognosis, even in cases of long duration.

Sutherland, in 1924, stated that his studies of seventy specimens led him to believe that pressure alone, even in the presence of active infection, was not sufficient to produce the usual nerve changes, but that it was necessary for the infection or inflammation to affect the nerve directly, either through the blood or lymph supply or by direct extension.

Jocqs, Paris, in 1924, expressed the belief that the tendency to attribute all retrobulbar neuritis to sinus trouble was a great mistake. The condition may arise from multiple sclerosis or from various indeterminate infections. He states that it is surprising how many cases recover spontaneously. When he suspects retrobulbar neuritis he employs decongestive methods and conservative surgery, such as resection of the septum and resection of the middle turbinate.

Jocqs is hardly consistent, as he states his disbelief in the sinus etiology, but at the same time directs his treatments to the sinuses. His use of the phrase "various indeterminate infections" is indicative of a lack of accuracy, both in thought and in expression.

White, in several communications during 1925, emphasized the salient points he has so convincingly brought to the attention of the profession from time to time during the last few years. It is not too much to say that no one man has contributed quite as much to this subject as White of Boston.

Sir John R. Parsons emphasizes the extreme vulnerability of the maculopapillary fibers and believes it is quite possible that some cases of acute retrobulbar neuritis, due to toxic agencies, may be due to primary involvement of the ganglion cells in the brain from which the maculopapillary fibers are derived.

While optic neuritis secondary to sinus disease is now an accepted clinical fact, it is obvious that there is a considerable difference of opinion as to the exact pathologic nature of the nerve involvement. What is the pathway followed by the active agents, and in what manner does the pathology in the nerve develop? Our main difficulty in solving these problems lies in the absence of postmortem studies in any given case. These patients do not die, and the future does not hold out any great

hope that we may be able to study even a small number of these cases at the autopsy table .

Birch-Hirschfeld reported a case in which he found the typical degeneration of the maculopapillary fibers, which would indicate irreparable changes in the nerve. De Kleijn and Gerlach found in their case, though the central scotoma had existed for more than seven months, there was almost no change in the optic nerve. They found the veins and capillaries of the nerve and nerve sheaths more filled than usual and a little infiltration of some of the sheaths. These two cases illustrate the two main types, one in which we have a reparable lesion and one in which we have an irreparable lesion.

Another case of De Kleijn and Gerlach demonstrated that the sinus infection had penetrated the thick bony partition by way of the sheaths of a blood vessel. It must be assumed, however, that those cases in which the nerve is well separated from the sinuses by a thick bony wall are less susceptible to invasion than those in which dehiscences in the bone exist. It is also a fair assumption in those cases in which the nerve is well surrounded by a firm bony wall, that a toxic edema of the nerve will result in more pressure, and, in consequence, greater damage to the nerve.

In this discussion we have intentionally limited ourselves to cases of posterior sinus neuritis. A number of cases of optic neuritis have been reported as due to infection in the other sinuses.

Dowling has reported a case cured by the elimination of an antrum infection.

Williams, London, in 1924, reported a case cured by operation on both antra.

Simoni-Mackler, Vienna, in 1924, reported a case cured by relief of a frontal sinus infection. One author reports a case as due to an infection of the anterior ethmoid cells, which was cured by curettage of these cells. In the cases reported as due to infection of the sinuses, other than the posterior sinuses, in which the posterior sinuses were said not to be involved, it cannot be said that the reports in any way proved that the posterior group were not also concerned in the pathologic picture. It may very well be true that proper attention to infection in the anterior group gave sufficient relief to the

posterior group to bring about a favorable result. The extraction of infected teeth and the removal of infected tonsils have resulted in a subsidence of the neuritis in some cases reported.

It is accepted that any focus of infection may cause an optic neuritis just as certainly as it may cause a neuritis of any other nerve. When the optic nerve is involved in this way, however, the results are serious, due to pressure within the optic canal.

Stark believes that multiple sclerosis and sinus blindness have a common etiology and that both are due to various intoxications and infections acting as a toxin circulating in the blood and lymph streams. He furthermore considers the sinus pathology to be due to the sensitization of the tissues of the sinus by bacterial proteins producing an allergy which results in a localized anaphylactic reaction each time the individual comes in contact with the particular infection to which he happens to be sensitive. When the nerve happens to be in intimate relation with the sinuses its susceptibility is increased through a diffusion of the anaphylactic reaction to the nerve tissue.

Up to the last few years the theory has been accepted that the invasion of the nerve was by contiguity, the inflammation spreading to the nerve structure by direct extension. More recently the toxic idea of involvement has received more attention and is at present accepted by some as a better conception of the pathology in a great majority of the cases.

Krauss, in 1909, expressed the idea that the neuritis was due to a local toxemia rather than to an inflammatory process. He considers the rapid subsidence of the neuritis, so often seen after opening the sinuses, is due to elimination of the source of the toxemia and a rapid drainage of the toxins from the nerve tissue through the lymphatics. The fact that the maculopapillary fibers are selected for specific action lends emphasis to the toxic theory.

MacWhinnie found that probing the sphenoid sinus immediately increased the congestion of the fundus, and this led him to believe that the neuritis results from the absorption of toxic products.

Gradle states that the infection or edema passes from the sinus periosteum through the diploic veins and lymph channels to the periosteum of the optic canal, which is inseparable from

the sheath of the nerve, or possibly through the periosteal vein directly to the central vein of Vossius. If the periosteal fibers are alone involved, causing pressure upon the periphery of the nerve within the canal, the peripapillary bundles alone will be involved and an enlargement of the blind spot will result. If the process extends further, and involves the central vein of Vossius, surrounding it by edema, the neighoring maculopapillary bundles will be involved and a central scotoma result. He does not consider the anatomic relationship important, as he believes invasion is always transmitted by the soft tissues alone.

In support of the toxic theory, it is well to remember that the central maculopapillary fibers are the first to be affected in retrobulbar neuritis and that they are undoubtedly the most sensitive bundles in the nerve. From the foregoing it may be accepted that invasion of the optic nerve may occur in several ways. Infections of the posterior sinuses may unquestionably extend by contiguity to the tissue of the optic nerve. That this liability is increased by the unusual anatomic relation often present has been pointed out.

The toxemia cases as such probably constitute the smaller number of cases. It is undoubtedly true that in a fair proportion of cases both direct extension of inflammation and toxic invasion are factors in producing the ophthalmic findings. Infection in posterior sinuses, as well as in any of the accessory sinuses, tonsils, teeth, or anywhere in body, may invade the blood and lymph stream and cause a toxic neuritis of the optic nerve. It is well to also keep in mind in every case that optic neuritis may be caused by alcohol, lead, tobacco, drugs and syphilis.

In bacteremia from any cause, the infective organism may invade the optic nerve by way of the blood stream or lymph channels. This may result in an embolism or in an obliterating endothelial infiltration. Hyperplasia of the posterior sinuses, in the presence of infection, increases the likelihood of nerve involvement.

Finally, we may consider the possibility of anaphylaxis as a cause, although I have never seen a case which I could properly ascribe to anaphylaxis, or in which I believe anaphylaxis played even a minor part.

In any given case the prognosis depends upon the virulence of the invasion, the duration before relief is instituted and the size of the optic canal. The loss of vision may be complete without necessarily meaning a poor prognosis. Beginning atrophy always means a bad prognosis, although it is surprising how much restoration of vision may result in the presence of considerable atrophy, provided the measures of relief are sufficiently thorough. While the dramatic cases are those in which the loss of vision is sudden and complete and in which the operative measures are prompt, with an almost immediate return of vision, it is amazing how much improvement results in some of the cases of several months' duration. Of course, a guarded prognosis is in order in the long standing cases, although a hopeless prognosis should never be given except where complete atrophy has already occurred.

The optic nerve, as has been previously mentioned, does not have a separate sheath and does not possess the power of regeneration. When the optic nerve tissue is destroyed, in whole or in part, it so remains, and for that reason it behooves us to act promptly once the diagnosis is made.

The diagnosis depends upon the active cooperation of the ophthalmologist and rhinologist. In practically every instance the ophthalmologist sees the case before the rhinologist. The patients are not, as a rule, aware of sinus disease, but they are at once aware, with rare exceptions, of defective vision. I can recalled two instances in which the individual was unaware of total blindness in one eye of undoubted long standing. The ophthalmologists, I believe, meet this situation fairly often.

Unfortunately, there are no characteristic symptoms of optic neuritis due to sinus disease. These cases, however, frequently present a picture which is at least suggestive of a rhinologic neuritis. Sudden loss of vision in one eye with no evident cause obtainable from the history, certainly suggests sinus investigation. Measures for a complete investigation should be at once instituted, including rhinologic diagnosis and a Wassermann. In the early stages the eyeground may be normal. The characteristic picture at this time is a central scotoma, contraction of the visual field and enlargement of the blind spot. The first loss of function is in the central and peripheral fibers. The central fibers are affected first, and it

is evident that these fibers are most susceptible to pressure or toxic edema. There may be an annular scotoma. The scotomata are, in the beginning, for colors only and later for white. Very often the enlargement of the blind spot appears first. These findings are diagnostic of a retrobulbar neuritis, but are in no way peculiar to neuritis of posterior sinus origin. Such a neuritis could be due to syphilis, tuberculosis, multiple sclerosis or toxin from any focus of infection.

Nasal examination may not reveal the presence of gross infection. If there is evidence of purulent infection of the posterior sinuses or evidence of polypoid degeneration, it only serves to emphasize the need of surgical intervention. This, however, is not the usual picture. In most instances nasal examination reveals only a slight congestion of the middle turbinate, usually accompanied by obstruction in the middle meatus. We are dealing with a closed sinus in most cases, with little evidence of infection to be found within the nasal passages. In fact, the picture presented within the nose may, in some instances, be considered normal. It must be accepted that the complete absence of any sign of disease within the nose is not sufficient to exclude sinus infection. Examination with the roentgen rays is always indicated. A positive picture is always helpful and supports the decision to operate. A positive picture, however, may not mean active infection, but infiltration and thickening from a previous infection. A negative picture should never preclude the decision to operate, as the area which we are considering is very difficult to picture satisfactorily, and the posterior external angle of the ethmoid capsule may contain pus and even contain hyperplastic material without being in evidence even in a well taken picture. The optic foramen should be pictured and measured. A small foraemn with marked diminution in vision indicates that delay is dangerous. A large foramen with only slight diminution may call for a fair trial of conservative measures. This is especially true in an early case which is not progressive. Given such a case and an intranasal condition which lends itself to successful conservative treatment, such may be indicated.

If conservative measures do not result in an immediate betterment, more radical treatment is at once imperative. The conservative measures consist in shrinking the middle tur-

binate with cocain adrenalin solution, argyrol tampons and gentle saline irrigations. This should be done at least once every day, or more often, if possible. If time is being consumed by diagnostic measures, such as a Wassermann, or a neurologic examination, or in obtaining consent to operate, these conservative measures should be instituted in the hope that the delay will not be too costly. If the slight change for the better should follow these conservative measures, it is of extreme diagnostic value as showing the source of the neuritis. Those who believe that suction is of value in sinus infection will, of course, add this method of treatment to that above suggested. For my part, I shall continue not to use suction in this particular type of infection. Conservative measures should not be persisted in unless immediate benefit results therefrom.

Operative measures should be instituted for all cases in which no known cause can be determined other than possible sinus disease. It is not always wise to assume that a patient with a positive Wassermann and a unilateral optic neuritis is of necessity suffering from a syphilitic neuritis. Operation on the sinuses may be indicated in such a case. Syphilis certainly does not diminish the possibility of sinus infection. If a toxic source, other than the posterior sinuses, is suspected, the source of toxicity should be at once eliminated. If the tonsils or teeth or antra show positive evidence of infection, their surgical treatment should not postpone surgical attention to the posterior sinuses. This is particularly true if the blindness is complete or progressing or of considerable duration.

There is no need to describe the operative technic for opening the posterior ethmoid cells and sphenoid sinus. Each operator may choose the method which in his experience has given him the best results. It is imperative, however, that the posterior superior angle of the ethmoid capsule be completely exenterated. The area may consist of a single large cell, or it may comprise several smaller cells. The operator should not consider his operation complete until he has assured himself that he has not left a single cell in this area unopened and drained sufficiently to afford permanent ventilation. The sphenoid sinus should, of course, always be opened as a part of the operative procedure. No packing or dressing should be

used postoperatively. As soon as possible gentle saline irrigations should be instituted. The local treatment of the operated area should aim to prevent the growth of granulation tissue or the formation of scar tissue which may in any way lessen the desired result, namely, complete and permanent ventilation of the posterior ethmoid sphenoid area.

In conclusion, I wish to emphasize the importance of not delaying operative relief in any case of retrobulbar neuritis, in the absence of other known and positive causes for the loss of vision.

CASE REPORTS.

Case 1.—Miss F., age 19, was referred to me on April 29, 1918, by her ophthalmologist. She gave no history of previous ill health. She had not been subject to colds in the head or headaches. On April 6th, she complained of pain over the left eye, which continued for two days. Immediately following this she noticed that she could not see well with the left eye. The diminution in vision becoming more marked, she was fitted for glasses without any improvement in the vision of the left eye. She was seen for the first time by the ophthalmologist on April 26th, who found an optic neuritis of the left eye with total blindness. She was referred to me on April 29th for investigation of the sinuses. Examination revealed complete obstruction of the left side of the nose. The inferior turbinate was in contact with the septum and the middle turbinate filled the middle meatus. The mucous membrane was red and swollen, but no discharge of pus was seen anteriorly. The right side of the nose was normal. Postnasal examination detected no discharge of pus at the time of examination, and the mucous membrane of the nasopharynx showed no evidence of inflammation. The posterior end of the middle turbinate, however, was red and swollen. A diagnosis of a closed infection was made. On this date, under local anesthesia, I removed the left middle turbinate, opened the frontal sinus, removed the ethmoid cells and opened the sphenoid sinus. Operation revealed a great deal of cell proliferation and polypoid degeneration of the ethmoid capsule. The sphenoid sinus showed swelling of the mucous membrane and considerable mucoid fluid. The ophthalmologist reported that the optic

neuritis showed improvement immediately after the operation and completely resolved in about two weeks without any atrophy. Restoration of vision was perfect. In response to a note, the patient reported at my office on October 25, 1918, at which time the nasal condition was satisfactory, and the patient was not conscious of any disturbance whatever. The vision in the left eye was perfect.

Comment.—This patient was not seen until twenty-one days after diminution in vision was first noticed. The vision gradually became worse for a period of three weeks, at the end of which time total blindness was present. Because of these facts and the findings within the nose, operation was performed at once without waiting for an X-ray picture or a Wassermann. The result justified the procedure.

Case 2.—Mrs. C., age 33, was referred to me by her ophthalmologist on March 23, 1920. She gave a history of having had a severe attack of influenza six years previously, at which time she had trouble with her nose. Following this her nose was not as free as formerly, and she had a great deal of discharge from both sides. Since that time she has seemed to have a constant cold in the head. She has had a great deal of frontal headache. Six weeks previous to her visit she began to feel ill, with increased headache. Four weeks ago she noticed what she called double vision, which continued for one week. Since this time she has not been able to read or sew. With this visual disturbance, severe pain in the head has been continuous. She has not been conscious of a cold in the head. The ophthalmologist reported a partial obliteration of both discs and markedly contracted visual fields on both sides.

Examination of the nose revealed a fairly normal septum. The left middle turbinate was swollen and the anterior ethmoid cells were covered with pus and showed marked infiltration. The frontal sinuses and antra were not involved. The right side anteriorly presented no evidence of infection. Postnasal examination revealed a mucopurulent discharge from both sides. The mucous membrane of the nasopharynx and oropharynx was inflamed.

On March 25th, under general anesthesia, a complete exenteration of the anterior and posterior cells of both sides was

performed, and both sphenoid sinuses were thoroughly opened. The ethmoid cells on the left were found to be in the late stage of infection, the entire ethmoid capsule being filled with pus, with marked cell proliferation. The left sphenoid sinus contained pus and polypi. The ethmoid cells on the right side showed cell proliferation anteriorly, but no pus, while posteriorly the capsule showed pus and infiltration. The right sphenoid sinus contained pus. On the third day following operation, the patient was able to read the newspaper, a striking contrast to her inability to read even the largest type previous to operation. The headache and scalp soreness were entirely relieved by the second day. The patient was seen at intervals for postoperative care. The ophthalmologist reported that examination in April showed apparently normal optic nerves with normal vision. The ophthalmologist reported that on July 20th the eyes were normal and he would have no occasion to again see the patient. I last saw her on September 21st for a final check up. The nasal condition was perfect. She considered herself perfectly well and her eyesight to be as perfect as it had ever been.

Comment.—This case does not present the usual picture. This patient had had for six years an active chronic infection of the sinuses. Six weeks previous to her first visit she had what was apparently a sudden increase in activity of the sinus infection and for four weeks she had been unable to see. Operation was followed by an immediate return of vision. One would hardly expect so prompt a restoration of function in this type of case.

Case 3.—Mr. B. C., age 42, was referred by his ophthalmologist on January 15, 1921. He gave a definite history of rheumatism and tonsillitis. Six weeks previous to his first visit he had developed a violent pain in the right eye. No external evidence of eye inflammation was to be seen at this time. At this time he saw an ophthalmologist in a distant city, who diagnosed his trouble as optic neuritis. The pain in the eye continued for four weeks. Vision in the right eye has been blurred ever since the pain began. He has not been conscious at any time of trouble in his nasal passages. The referring ophthalmologist reported a well developed retrobulbar neuritis with contracted field.

Nasal examination revealed obstruction due to malformation of the septum. The right middle turbinate was congested, but no discharge anteriorly was found on either side. There was moderate posterior discharge on both sides. The tonsils and nasopharynx were inflamed. The X-ray pictures showed some clouding in the right ethmoid area.

On January 29th, a submucous resection of the septum was done. Following the operation the vision improved sufficiently to postpone further surgery. The ophthalmologist reported on March 30, 1922, that the vision in the right eye with correction was normal. The optic disc was somewhat pale.

Comment.—Notwithstanding the good results in this case, I believe it would have been good judgment to have operated upon the posterior ethmoid cells and sphenoid, in addition to the septum. Furthermore, the infected tonsils should have been removed.

Case 4.—H. G., age 62, was referred to me by the ophthalmologist on May 16, 1921. He gave a history of having lost the vision of the left eye five weeks previous to my first examination. The ophthalmologist reported optic neuritis with total blindness.

Operation was done at once with the hope of visual improvement. The ethmoid cells were completely removed and the sphenoid sinus opened. This patient was a clinic case and postoperative control was difficult.

In response to a written communication of July 14, 1925, he replied that vision in the left eye did not return and that he had been told his blindness was permanent.

Comment.—This case illustrates the danger of delay in some cases. He had been totally blind for five weeks previous to operation, and it is fair to assume that his neuritis antedated his total blindness by a considerable period.

Case 5.—Mr. C. G., age 18, was referred to me by his ophthalmologist December 8, 1921. The left eye had been totally blind since infancy. The ophthalmologist reported acute optic neuritis and acute retinitis. The vision was reduced to 1/10 of normal.

The patient gave a history of frequent colds in the head with profuse discharge and nasal obstruction. Examination of the nose showed practically complete obstruction, due pri-

marily to a deformity of the septum. The mucous membrane of both sides was swollen, and there was a profuse purulent discharge anteriorly and posteriorly on both sides. On December 9th a submucous resection of the septum was done and the right middle turbinate removed. On December 22nd he was able to see letters one-fourth of an inch high, distant seventeen inches, which was a decided improvement. On December 23rd he could see the same letters a distance of twenty-four inches. On December 27th he was able to read the newspaper.

On January 9th, although the vision was improving, the ethmoid sphenoid area was operated upon. Following this procedure the vision in the right eye returned to normal. Observation on December 21, 1923, showed normal vision had continued.

On September 22, 1924, he contracted a severe cold, which somewhat affected his vision. Examination of the operated area at this time showed it be in perfect condition. The left ethmoid area at this time was acutely involved. These cells were operated upon thoroughly, and the disturbance in vision in the right eye very promptly subsided and there has been no further trouble up to date.

Comment.—Total blindness since infancy in the left eye made the loss of vision in the right eye a matter of great importance. Undoubtedly the ethmoid sphenoid area should have been operated upon at the time of the first operation. It is interesting to note the apparent effect of an acute ethmoiditis of the left side on the vision of the right eye.

Case 6.—T. M., age 16, was referred to me by his ophthalmologist on January 19, 1922. This patient gave a history of having had difficulty in seeing with his right eye for the past two and a half months. He has not been aware of any nasal trouble or colds in the head. The ophthalmologist reported vision in the right eye reduced to 1/5 one week ago, but now reduced to 1/10 with swelling of the disc. The left eye has always been "weak."

Examination of the nose showed no real obstruction and no gross evidence of infection in any of the sinuses. There were considerable adenoids, and the tonsils showed chronic infection. On January 20th he was referred to the hospital for a Wassermann and an X-ray of the sinuses. On this day the

tonsils and adenoids were operated upon. The Wassermann was found to be negative and the X-ray failed to reveal any evidence of sinus infection. As the vision in the right eye was steadily becoming less, I operated upon the right ethmoid sphenoid area on February 3rd. On February 9th there was only slight improvement in vision. On February 18th further improvement was noted. On April 17th the swelling of the disc had subsided, although blurring of the nervehead was still present. The vision showed only very slight improvement. We were unable to obtain further observations on this patient, as his mother seemed to consider he was well.

Comment.—For two and one-half months previous to our seeing him he had defective vision, which probably indicates that his trouble began some time before this date. Very costly delay was experienced in securing permission to operate. The follow up was unsatisfactory.

Case 7.—A. H. was referred to me by his ophthalmologist on March 4, 1922. This patient gave a history of failing vision in both eyes beginning four months previous to my first examination. The right nerve showed atrophy at this time and vision was practically lost. The left eye showed optic neuritis with vision greatly reduced. A double ethmoid sphenoid operation was done on the day of my first examination. On March 10th the vision in the left eye was slightly improved. On March 29th the vision in the left was very much better, and the right eye showed considerable gain in vision.

Comment.—At the time of the first examination this case had progressed far beyond the safety period. The betterment in the right eye was as much as could be expected, and the left eye improved sufficiently to lead us to hope for a fair return of function. We were unable to follow this case further.

Case 8.—A. M. was referred to me by her ophthalmologist on November 16, 1922. She gave a history of a cold in the head for several days. She complained of difficulty with vision in the left eye for several weeks. The ophthalmologist reported optic neuritis of the left side with blurring of the vision and contracted fields. Examination of the nose showed a high deviation of the septum on the left side with obstruction in the middle meatus. A diagnosis of subacute ethmoiditis of the left side was made.

Conservative measures of treatment were followed for four days. The vision not improving, the sphenoid ethmoid operation was done on the left side on November 20th. On November 27th the ophthalmologist reported that the neuritis was subsiding and the vision improving. Uncorrected vision was improved and corrected vision was normal. The improvement continued and the last report by the ophthalmologist on June 6, 1925, stated that the subsidence of neuritis had been complete and the vision was normal with correction.

Case 9.—M. P., age 22, was referred to me by his ophthalmologist on January 22, 1923. He gave a history of having had pain in the region of the left eye for five days. He had noticed during this period some discharge into his throat. Three days ago he noticed blurring of vision in the left eye and two days later it became much worse. The ophthalmologist reported retrobulbar neuritis of the left side with a central scotoma for colors.

At the time of my first examination he could not distinguish large objects until within six inches of the eye.

Nasal examination at this time revealed a high left sided deviation of the septum with obstruction of the middle meatus. The left middle turbinate was swollen, but no anterior discharge was in evidence. There was a moderate posterior discharge from the left side. The ethmoid sphenoid operation was done immediately.

On February 5th there was only slight improvement in vision. On February 7th the improvement in vision was decided, and he could distinguish objects at some distance. On February 8th he could read large letters. On February 15th the ophthalmologist reported he could read the sixth line, which was nearly normal vision. The vision of the left eye at this time was as good as that of the right eye.

On March 14th a submucous resection of the septum was done to establish a better postoperative nasal condition. A final report from the ophthalmologist on March 5, 1925, stated that the left eye was normal without correction.

Case 10.—A. G. was referred to me by his ophthalmologist on February 19, 1923. This patient gave a history of having had influenza in 1916, with resultant loss of vision in the right eye. In October, 1920, he began to have defective vision in

the left eye. By November, 1924, the active trouble in the eyes had subsided. The right nerve showed atrophy and the left showed considerable paleness. At the time of my first examination he could only distinguish light and dark with the right eye and hand movements with the left eye. Examination of the nasal passage revealed a double ethmoiditis, and a double ethmoid sphenoid operation was done with the hope of saving what vision remained. The other examinations, such as the Wassermann, were negative. Three weeks after the operation the patient could distinguish objects with the right eye, but at this time the vision in the left eye was the same. In June, 1925, the ophthalmologist reported that considerable improvement in the vision in both eyes had gradually developed and that with correction he would be able to engage in a useful occupation.

Comment.—This case was of seven years' duration, and the considerable improvement noted was as much as could be expected.

Case 11.—D. H. This patient was referred to me by his ophthalmologist on February 19, 1923. The patient gave a history of failing vision in both eyes for the past eight months. At the time of my first examination the ophthalmologist reported partial atrophy of both nerves and light perception only. On February 23rd a double ethmoid sphenoid operation was done. On February 28th the ophthalmologist reported hand movements at two feet for the right eye and some betterment in the left eye. On March 6th the right eye showed 15/70 and the left eye 15/9, which was a great improvement. On March 11th there was better vision in both eyes. Although the Wassermann was negative, salvarsan was given at the time. Following two salvarsan injections there was no fundus change. In June, 1925, the ophthalmologist reported that steady improvement in vision had followed the operative procedure and that finally corrected vision was fairly satisfactory.

Comment.—This case appeared hopeless, but was much benefited.

Case 12.—B. T. was referred to me by his ophthalmologist on April 20, 1923. This patient complained of blurring of the vision in the right eye for about six weeks. The ophthalmolo-

gist reported a large central scotoma. The patient thought he had had a slight cold when the trouble began. Nasal examination showed obstruction in the middle meatus on both sides. There was no discharge anteriorly or posteriorly. The Wassermann was negative. On April 25th a submucous resection of the septum was done, and on May 8th the right ethmoid sphenoid operation was done. The ophthalmologist reported that the scotoma cleared up following the operative measures. Comment.—The ethmoid sphenoid operation should have been done at the time the septum was operated upon, as thirteen days' advantage was lost.

Case 13.—H. D. This patient was referred to me by her ophthalmologist on May 16, 1923, with a diagnosis of a right optic neuritis. The patient gave a history of defective vision in the right eye for about six months. She complained of frequent colds in the head, accompanied by a discharge into the throat. Nasal examination revealed obstruction in the right middle meatus, but no discharge anteriorly or posteriorly. On May 17th the ethmoid sphenoid operation was done on the right side. On May 23rd the vision was improved. On June 22nd the ophthalmologist reported the eye condition thoroughly satisfactory.

Case 14.—D. L., age 15, was referred to me by his ophthalmologist on June 22, 1923. This patient first noticed blindness in the right eye two months ago. The loss of vision was sudden. The vision so far has shown no improvement. He had had the tonsils and adenoids operated upon eight years previously. The ophthalmologist reported optic neuritis of the right eye and total blindness.

Examination revealed marked nasal obstruction, due to malformation of the septum, and ethmoiditis of the right side. There was a profuse purulent discharge anteriorly and posteriorly. The tonsils and adenoids were present and were much infected.

On June 25th, under general anesthesia, a submucous resection was done. The ethmoid sphenoid operation was done on the right side and the tonsils and adenoid were removed. On July 6th the ophthalmologist reported he could see two lines. On September 19th the ophthalmologist reported he could read five more lines than on July 6th. On November 2nd, the re-

port stated that the nerve inflammation had subsided and that the vision was, uncorrected, half normal. On April 20, 1925, the eye report showed the right eye to have 6/12 plus, with a slightly pale nerve, and the left eye to have 6/45 vision.

Case 15.—A. W., age 16, was referred by her ophthalmologist on October 25, 1923. She gave a history of having had a cold in the head two weeks previously, with diminution in vision beginning one week ago. She has had pain in the left eye. The ophthalmologist reported a left sided retrobulbar neuritis with a central scotoma. Examination of the nose showed a high deviation of the septum to the left, with obstruction in the middle meatus. There was very slight congestion of the left middle turbinate, but no discharge anteriorly or posteriorly. On October 27th the ethmoid sphenoid operation was done on the left side. On November 2nd the eye report stated that vision had improved from the first line to the third line. On November 7th she could see objects more distinctly. On November 16th the vision again showed improvement. On November 26th the eye report stated that vision was about normal, although there had been a slight cold in the head. On January 22, 1924, vision was practically normal.

Case 16.—W. W. was referred by his ophthalmologist on February 16, 1924. This patient gave a history of defective vision for nearly a year. The eye report stated that both nerves showed partial atrophy and vision was, right 20/200, left 20/40. Two and a half months previous to my examination he had had the ethmoid sphenoid operation done on the right side with no improvement in vision. The Wassermann was negative.

Examination showed the postoperative condition in the right ethmoid sphenoid area to be satisfactory, although there was some posterior discharge from this side. The left side showed a chronic hyperplastic ethmoiditis with discharge posteriorly. Both tonsils showed much pus on pressure. On March 5th the ethmoid sphenoid operation was done on the left side and the tonsils were removed. In May, 1924, the ophthalmologist reported that the enlarged blind spots had become normal and that vision had improved to, right 20/70, and left 20/20, which was more than had been anticipated.

Comment.—As the vision had not improved following the earlier operative procedure, it is fair to assume that the improvement resulting from the second operation was due to the elimination of infection in the tonsils and the left ethmoid sphenoid area. This case received careful postoperative local treatment for both ethmoid sphenoid areas, which was undoubtedly a factor in the final outcome. It may be that in this case a toxic neuritis from the tonsils was a part of the pathology.

Case 17.—M. C. was referred by his ophthalmologist on March 11, 1924. Three months ago he noticed that he was unable to see well with the left eye. The vision has become steadily worse, and at present he cannot see any of the letters on the chart. The eye report stated that a well developed retrobulbar neuritis was present, with much swelling of the disc. Nasal examination revealed marked obstruction on the left side, due to malformation of the septum. The ethmoid area was much inflamed and there was a profuse discharge posteriorly from the left side. The tonsils were much infected and swollen and adenoids were present. On March 14th a submucous resection of the septum was done; the left ethmoid sphenoid area was operated upon and the tonsils and adenoid were removed. The procedures were all done at one time under local anesthesia. On March 26th the vision showed some improvement. On July 3rd the ophthalmologist reported the eye condition to be much better. On October 6th the eye report stated the vision was improved and that the absolute scotoma had disappeared, with the eyeground normal. Vision with glasses in the left eye was 20/200. On June 10, 1925, the eye report stated the improvement was continuing. On October 19, 1925, he could see large letters near by, and his color perception was normal.

Comment.—The optic canal measurements in this case are as follows: Right—Somewhat spherical in shape. The vertical diameter was 5.5 mm., and the horizontal diameter was 6 mm. Left—Somewhat irregular. The vertical diameter was 5.8 mm., and the horizontal 4.8 mm. in the median portion and 5.7 mm. at its upper border. The left canal was irregular, and one measurement 4.8 mm. was small. This case was of three months' duration, and the left canal did not measure up to the

standard of the right canal, both of which facts have a bearing on the outcome of this case.

Case 18.—T. W., age 68, was referred on March 31, 1924. The ophthalmologist reported poor vision for over three years. Both nerves were pale. For the past year the vision in the left eye has become much worse and the right slightly less clear. The Wassermann was negative. The X-ray showed involvement of all the sinuses. Nasal examination showed malformation of the septum, and both ethmoid areas contained pus and some polypi. On April 2nd the septum was resected and a double ethmoid sphenoid operation was done. On April 23rd the eye report stated that the vision in the left eye was improved 100 per cent, but the right eye was unchanged. On June 7th the eye report stated that the vision in both eyes was very satisfactory with corrected vision.

Case 19.—T. A., age 65, was referred by his ophthalmologist on April 1, 1924. The eye report stated that the vision in the left eye had been getting gradually worse for the past year. Examination revealed a left optic neuritis with a swollen and reddened disc. The vision at this time was only for large objects. Nasal examination showed a high deviation of the septum to the left, with obstruction and edema of the middle turbinate. There was considerable posterior discharge on the left side. On April 11th a resection was done and an ethmoid sphenoid operation. On May 14th it was noticed that the postoperative condition was satisfactory and that the vision was improving. A report several months later stated that vision in the left eye was, with correction, nearly normal.

Case 20.—J. P. was referred on April 23, 1924. The eye report stated that vision in both eyes was much reduced when examined first in February, 1923. At this time there was a double retrobulbar neuritis, with swelling of both discs. The X-ray picture of the sinuses was negative. The Wassermann was negative. There were peripheral scotomata. When seen in July, 1923, the nerve condition appeared to be unchanged, but the vision was more reduced, and the peripheral scotomata were increasing. On April 23, 1924, both nerves showed partial atrophy. Nasal examination revealed a hyperplastic double ethmoiditis with a moderate posterior discharge. The tonsils

were badly infected. On April 30th a double ethmoid sphenoid operation was done and the tonsils were removed. In April the eye examination showed: Right, 1/15, left 1/15; in August, right 1/12, left 1/15, and on February 10, 1925, right 1/2, left 1/13, which the ophthalmologist considered a remarkable improvement. The scotomata were gone. The patient stated at this time that he was using his eyes and had no difficulty in reading with his glasses.

Comment.—This case was of long duration and had considerable atrophy before operative attention.

Case 21.—A. A. was referred by her ophthalmologist on June 4, 1924, with a diagnosis of acute retrobulbar neuritis of the left side, of three weeks' duration. She had not been conscious of a cold in the head at any time. She had, however, complained of a left sided headache and pain about the left eye.

Nasal examination showed a moderately swollen left middle turbinate, but otherwise no pathology was in evidence. On June 6th the ethmoid sphenoid operation was done on the left side. On June 7th, twenty-four hours after the operation, some improvement in vision was noticed. On July 14th, the eye report stated that the nerve and vision were normal.

Case 22.—M. D. was referred December 17, 1924, with a diagnosis by the ophthalmologist of optic neuritis of the left side, with a pale nervehead and total blindness. This patient gave a history of pain in the left eye, beginning ten days previous to our examination. The pain had continued, although at present it was somewhat less. She stated that the upper lid had been swollen and that the eye appeared larger. The Wassermann was negative. She had had a severe cold in the head one month previously. Nasal examination revealed complete obstruction in the left middle meatus, due to a large middle turbinate. There was no other pathology except a very slight congestion of this turbinate and a slight posterior discharge. On December 9th, the ethmoid sphenoid operation was done on the left side. On February 7th the postoperative condition was satisfactory, but vision had not returned. The ophthalmologist stated that no return of vision was to be expected, as atrophy had continued.

Comment.—This case illustrates the rapidity with which atrophy and total blindness may develop with an apparently

moderate nasal pathology. It would have been of great interest to have had a picture, in this case, of the optic foramen.

Case 23.—M. B. was referred to me by her ophthalmologist on February 24, 1925, with a diagnosis of acute retrobulbar neuritis, with swelling of the disc of the left side. The patient gave a history of an attack of grippe three months prior to her visit. Two weeks ago she first noticed difficulty in seeing with the left eye. Nasal examination showed the left middle turbinate to be much congested; otherwise, no pathology was in evidence. I had known this patient for three years, and further examination at this time was not necessary. On March 2nd the ethmoid sphenoid operation was done on the left side. The improvement in this instance was gradual. In June, 1925, she could read good sized print. Previous to operation she could not read very large print. She stated at this time that the vision was steadily improving. The ophthalmologist considered the progress satisfactory. The optic canals in this case were as follows: The picture of the right side was not satisfactory. The left canal showed a vertical diameter of 4.5 mm. and a horizontal diameter of 4 mm. The shape was somewhat oval. The posterior ethmoid cells were shown to be in close relation to the left canal. The left canal was below normal in both diameters, which was significant in this case. We had here a very mild pathology in the sinuses, a marked loss of vision, and a slow return of function. The close proximity of the posterior cells to the canal increased the likelihood of invasion.

Case 24.—W. J., age 15, was referred to me by his ophthalmologist on June 1, 1925, with a diagnosis of an acute retrobulbar neuritis of the left eye, with very marked swelling and edema of the disc. Total blindness was present. This patient gave a history of having had a sudden and complete loss of vision one week ago. The blood and urine examinations were negative. The X-ray revealed no pathology in the sinuses. The picture of the optic canals showed the following: Right—Moderate size, somewhat spherical in shape, with a slight depression of the outer border. The vertical diameter was 5.8 mm., and the horizontal diameter was 4.9 mm. Left—Tendency toward oval shape. The vertical diameter was 5.4 mm., and the horizontal diameter was 5.8 mm. The cells of the posterior

ethmoid cells on the left side were in closer relation to the canal than those of the right side. The measurements of the left canal would lead one to give a favorable prognosis, while the close proximity of the posterior ethmoid cells to the canal on this side added a serious aspect, due to the greater vulnerability of the nerve.

Nasal examination revealed complete obstruction in the left ethmoid area, with congestion of the middle turbinate. This area gave a picture of inflammation, although no discharge was present anteriorly or posteriorly. On the same day the ethmoid sphenoid operation was done on the left side. On June 29th the eye report stated that the nerve swelling was subsiding and that the vision was improved from 3/20 to 8/20. On September 19th the ophthalmologist reported that the eye condition was a little more favorable. On October 19th the eye report stated that the improvement was still going on. The vision had improved to 20/200, and the papillitis and dilated vessels had all subsided. With corrected vision, the patient would have very satisfactory sight.

During the period in which I have been interested in this group of cases I have seen a considerable number in which the diagnosis was made and operative treatment advised, but no opportunity was afforded to carry out the measures advised. There have been, in addition to these, a number of cases in which operative treatment has been given, but the follow up has been impossible or unsatisfactory.

353 WASHINGTON AVENUE.

BIBLIOGRAPHY.

Onodi: The Optic Nerve and the Accessory Cavities of the Nose. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, Vol. XVII, p. 1; March, 1908.

Loeb: A Study of the Anatomic Relations of the Optic Nerve to the Accessory Cavities of the Nose. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, Vol. XVIII, p. 243; June, 1909.

Operative Surgery of the Nose, Throat and Ear. St. Louis, Vol. I, 1914.

Young: Journal of Laryngology, and Otology. Edinburgh, July, 1924.

White: Retrobulbar Neuritis from Posterior Accessory Sinus Disease, with Report of Seventeen Cases. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, Vol. XXVII, p. 793; September, 1919.

An Anatomic and X-ray Study of the Optic Canal in Cases of Optic Nerve Involvement. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, Vol. XXXIII, p. 121; March, 1924.

End Results of Sphenoidal Sinus Operations for Optic Nerve Disturbances. Laryngoscope, Vol. XXIV, p. 135; February, 1924.

Treatment of Optic Nerve Involvement as Determined by Optic Canal Radiographs. Laryngoscope, Vol. XXXIV, p. 255; April, 1924.

Blindness from Teeth, Tonsils and Accessory Sinuses. Laryngoscope, Vol. XXXV, p. 217; March, 1925.

Schaeffer: The Nose and Olfactory Organ. Philadelphia, 1920.

Westlake: Notes on Relation of the Optic Nerve to the Last Posterior Ethmoid Cell. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, Vol. XXXII, p. 729; 1923.

Caldwell: Diseases of the Pneumatic Sinuses of the Nose and Their Relation to Certain Affections of the Eye. New York Medical Record, 1893.

Halstead: Transactions of American Laryngological, Rhinological and Otological Society, 1901.

Sluder: Blindness Due to Postethmoidal Empyema, Acute. Laryngoscope, Vol. XVII, p. 883; November, 1907.

Van der Hoeve: Optic Nerve and Accessory Sinuses. ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, Vol. XXXI, p. 297; June, 1922.

Crane: Posterior Sinus Infection with Optic Nerve Involvement Journal A. M. A., Vol. LXXVI, p. 28; January, 1921.

Krassig: Rhinogenous Retrobulbar Neuritis. Arch. f. Ohren, Nasen u. Kehlkopfhlk., Leipsic.

Gordon: Ocular Manifestations of Inflammation of the Accessory Nasal Sinuses. Jour. Maine M. A., Vol. XIV, p. 71; November, 1924.

St. Clair Thomson: Optic Neuritis of Sphenoidal Sinus Origin. British Medical Journal, London; p. 925; June 2, 1923.

Wolfe: Some Etiologic Factors of Retrobulbar Neuritis. Kentucky Medical Journal, Vol. XXI, p. 229; May, 1923.

Crane: Nasal Accessory Sinus Infection and Orbital Disease. Laryngoscope, Vol. XXXIV, p. 174; March, 1924.

Demaria and Layera: Retrobulbar Optic Neuritis Accompanying Posterior Sinusitis. Arch. de Oftal., Hispano-Am., Barcelona, Vol. XXIII, p. 473; August, 1923.

Goris: Four Cases of Optic Neuritis of Extraorbital Origin. Oto-, Rhino-, Laryngol. Internat., Lyon, Vol. VII, p. 393; July, 1923.

Valude and Chantier: Optic Neuritis and Trephining of the Sphenoid Sinus. Ann. d' Ocul., Paris, Vol. CLX, p. 649; August, 1923.

Dowling: Relation of Maxillary Sinus to Ocular Disease. Laryngoscope, Vol. XXIV, p. 167; March, 1924.

Davis: Retrobulbar Neuritis of Nasal Origin. British Med. Jour., p. 873; November 10, 1923.

Van Den Wildenberg: Retrobulbar Neuritis from Latent Posterior Sinusitis Improved by Endonasal Intervention. Ann. de Mal. de l'Oreille, du Larynx, etc. Paris, Vol. XLII, p. 891; October, 1923.

Falk: Retrobulbar Neuritis Associated with Diseases of Nasal Accessory Sinuses, with Report of Two Cases. New York Med. Jour., Vol. CXVIII, p. 624; November 21, 1923.

Williams: Optic Neuritis Following Sphenoiditis. Jour. Ophth., Otol. and Laryngol., Vol. XXVII, p. 401; November, 1923.

Husik: Total Blindness of Both Eyes Cured by Ethmoid Operation. Laryngoscope, Vol. XXXI, p. 874; November, 1922.

Portmann and Pesme: Retrobulbar Optic Neuritis from Ethmoidosphenoiditis. Its Clinical Aspect and Special Charactertistics. Rev. de Laryngol., Bordeaux, Vol. XLV, p. 289; May 15, 1924.

Bourguet: Some Reflections on Socalled Surgical Cure of Retrobulbar Neuritis. Oto-, Rhino-, Laryngol. Internat., Lyon, Vol. VIII, p. 193; April, 1924.

De Stella: Operative Technic for the Treatment of Retrobulbar Neuritis of Endonasal Origin. Arch. Internat. de Laryngol., Paris, Vol. III, p. 161; February, 1924.

Vinsonneau: Retrobulbar Optic Neuritis and Sinusitis. Arch d'Ophth., Paris, Vol. XLI, p. 99; February, 1924.

Turner, A. Logan: The Relation of Visual Disturbances to Affections of the Nasal Cavities and Posterior Group of Sinuses. Jour. Laryngol. and Otol., Edinburgh; Vol. XXIX, p. 371; July, 1924.

Syme: Sphenoidal Sinus in Relation to the Optic Nerve. Jour. Laryngol. and Otol., Edinburgh; Vol. XXIX, p. 375; July, 1924.

Young: Retrobulbar Neuritis of Sphenoidal Sinus Origin. Jour. Laryngol. and Otol., Edinburgh; Vol. XXIX, p. 381; July, 1924.

Traquair: The Value of Visual Changes in the Diagnosis of Optic Nerve Disease Due to Latent Conditions of the Nasal Accessory Sinuses. Jour. Laryngol. and Otol., Edinburgh; Vol. XXIX, p. 384; July, 1924.

Dundas Grant: Notes of Cases of Ocular Disturbances Attributed to Nasal Disease with Recovery or Improvement, Following Operative Measures. Jour. Laryngol. and Otol., Edinburgh; Vol. XXIX, p. 397; July, 1924.

Sutherland: Retrobulbar and Ocular Neuritis Due to Hyperplastic Changes in the Ethmoidosphenoid Sinuses. Jour. Michigan State Med. Soc., Vol. XXIII, p. 279; July, 1924.

Jocqs: Treatment of Retrobulbar Neuritis. Clin. Ophth., Paris; Vol. XXVIII, p. 123; 1924.

Parsons, Sir John R.: Retrobulbar Neuritis. N. W. Med. Jour., Vol. XXIV, p. 4; January, 1925.

Simoni-Mackler: Congestion of the Frontal Sinus Accompanying Unilateral Retrobulbar Neuritis. Monatsch. f. Ohrenhlk., etc., Vienna; Vol. LVIII, p. 1126; December, 1924.

Williams: A Case of Latent Nasal Accessory Sinus Disease with Mental and Visual Impairment. Operation. Recovery. Lancet, London; Vol. CCVII, p. 1280; December 20, 1924.

Stark: Sudden Blindness Due to Suppuration of the Accessory Nasal Sinuses. Jour. A. M. A., Vol. LXV, p. 1513; October 30, 1915.

Retrobulbar Neuritis, Secondary to Diseases of the Nasal Sinuses. Jour. A. M. A., Vol. LXXVII, p. 678; August 27, 1921.

XVIII.

TREATMENT OF ATROPHIC RHINITIS BY IVORY IMPLANTS: PRESIDENTIAL ADDRESS.*

By Harry L. Pollock, M. D.,

Chicago.

To the Members of the Chicago Laryngological and Otological Society: The close of this meeting terminates my privilege of acting as your presiding officer. The year has passed all too quickly and will ever remain one of my pleasantest memories.

When I was honored with the presidency at our last annual meeting, I could only hope that my regime would be as successful as those of my predecessors. And now, looking back on it and judging from the monthly attendance and enthusiasm displayed, I trust that it has not fallen short. This is due almost entirely to the untiring efforts and helpful assistance of our incomparable secretary, Dr. Austin A. Hayden, and the cooperation and suggestion of the Council, as well as the encouragement and inspiration afforded me by the members of the organization. At this time I especially want to express my sincerest appreciation and thanks to those who, by the presentation of clinical cases, papers and discussions, have made the meetings so interesting and instructive. I feel that I have personally gained a greater scientific knowledge and experience through these contacts and know that those attending the meetings could not help but carry away some valuable thought or theory. On the other hand, I condole with those members who were so unfortunate or indifferent as to miss any or all of the meetings, since I know that they were losers thereby.

From my experience as president of this organization, there is just one suggestion that I would make to my successor, and that is the value of clinical meetings. I found that at these clinical meetings, more than at any other, the attendance and

*Chicago Laryngological and Otological Society.

interest were far greater and that they evoked discussions and suggestions which were of great practical value.

At the same time I do not wish to belittle the value of the presentation of scientific papers, for the standard maintained this year has been exceptionally high. But I would suggest the working out of a plan whereby clinical cases can be presented at each meeting before the reading of the papers.

I intend to digress this evening from the policy of my predecessors who have addressed you on the problems and future of otolaryngology, as well as to the undergraduate and postgraduate teaching of our specialty, by making the annual address somewhat of a scientific nature. For many years I have been deeply interested in the subject of atrophic rhinitis, with or without ozena, and I purpose this evening to tell you of my present treatment of this malady.

It is not my intention at this time to delve into the etiology, pathology or bacteriology except as they may be of interest to us in connection with the treatment. In a former paper, my thesis for admission into the American Laryngological, Rhinological and Otological Society, I presented various facts in regard to the etiology and pathology of this disease, so that a repetition at this time is unnecessary. Suffice to say that an abnormally large intranasal space is the greatest factor in keeping up the well known symptoms of this disease, viz., crust formation, stuffiness of nose, foul smell and a discharge, with secondary involvement of a pharyngitis or laryngitis sicca.

Whether any or all of these symptoms are due secondarily to a sinus infection, a disfunction of the endocrines, secondary to a hypertrophic rhinitis, or to a specific microorganism (Perez coccobacillus) or any other cause, the fact remains that so long as the abnormally large intranasal space is present the symptoms continue unabated. In the recent European literature many good results as to cure are being reported following the use of vaccines. But reports coming to our clinic from many of our specialists returning from abroad indicate that the ultimate cures reported in the literature are far from being as frequent as one would desire. We are further told that the best results are being obtained in those cases in which an attempt is made to lessen the abnormally large intranasal space, either by the Halle or Lautenschlager operations. In both, the idea

is to lessen the space by attempting to bring the lateral walls of the nose toward the septum.

Just after these procedures were published, I operated on several cases in accordance with their technic, and while they were somewhat formidable, I obtained fairly good primary results, but after a year the old symptoms returned, the lateral wall having a tendency to swing back in position, stretching the synechia which occurred at the time of the operation into mere threads, presenting the abnormal space similar to that found before operation.

Even before the Halle or Lautenschlager methods were presented, my associate, Dr. Joseph Beck, and I had conceived the idea of forcing the septum toward the lateral wall of the nose. We attempted to do this by means of intraseptal implants, placing them under the mucoperichondrium and thus forcing the outer septal wall toward the lateral nasal wall. Our first attempts were with inlays of paraffin, but it was not very long, being a foreign body, until they sloughed out. We then decided to try a homogeneous substance and began to employ fascia lata. This healed in very nicely, but in a very short time so much contraction occurred that the implants were scarcely discernible. Our next material, while very successful, was not always easily obtainable, viz., bone and cartilage from a previously operated septum resection. I found that it required two septi as a rule to fill up one side of an atrophic rhinitis space, and often it was impossible to obtain all three cases at the same time. When such fortunate circumstances did occur, our results were more than gratifying, as in nearly every case a physiologic cure resulted. Quite often too much shrinkage and absorption occurred after a year, so that the patients were not as free from the symptoms as we had anticipated. We usually waited some six months before operating on the second side, for fear of losing the nutrition of the septal cartilage, as occurred in one case, a resulting perforation.

Therefore, for reasons as above stated, we attempted to use cartilage or bone from the patient himself, cartilage from the rib or bone from the tibia. As occurs occasionally in all plastic intranasal surgery, infection sometimes took place, and in those cases we lost our transplant, following which it was

often difficult to persuade the patient to submit to another operation.

Having had good results from the use of ivory implants in plastic surgery about the head, I began to use this material for my intraseptal implants. Never having previously heard of anyone using this material in intranasal surgery, I was obliged to work out my own methods as to the size and amount to be used, and in the earlier cases did not, naturally, obtain as favorable after results as I did in my later cases. The shape of the transplant, amount used, and the placing of same was a matter of experience.

The ivory employed is obtained from the tusks of the elephant. The shape and amount used depends upon the individual case. In the earlier cases I employed too much and failed to round off the sharp corners, so that in two instances the ivory implants sloughed out. But I am sure that if I had used less ivory in either case, the implants would have remained. The implant material is obtained in large pieces, and one must have a complete outfit, consisting of saws, files and vises, etc., for obtaining the size desired. In the slides which are to follow I shall show you the paraphernalia with which we work. Ivory is similar in its composition to bone and therefore we expect to obtain similar reactions from its use. It is now over a year since I have been using this method and am presenting it for what it is worth. It is, indeed, too early to make any definite statements as to its ultimate merit, and I feel that I have had comparatively too few cases to warrant general statements of real value. Whether in the course of a few years the implants will slough out remains to be seen, but I am presenting this method in the hope that all of you will give it a fair trial and report your results.

In my later cases I drilled holes through the implant, trusting thereby the resultant connective tissue would grow through the openings and, while holding the implant in place, would also give nourishment to the underlying cartilage.

Since every case of atrophic rhinitis is associated with chronic suppurative ethmoiditis and many cases are associated in addition with chronic suppuration of the other sinuses, especially the antrum, attention must be given the sinuses, and

every effort, surgical or otherwise, must be made to eradicate the underlying pathology before attempting any intraseptal implants. Every patient must have a thorough exenteration of the ethmoid cells without removal of the middle turbinate body, as it is preferable to preserve as much intranasal tissue as is possible. Following the sinus operation one usually waits for six weeks before doing the intraseptal implant, or longer if the conditions do not justify further procedure at the end of the six week period. A number of small perforated ivory implants are prepared, ranging from one-half to one and a half inches in length, from one-quarter to one-half inches in height and from one-eighth to one-quarter inches in thickness. All sharp edges must be well rounded. Since no shrinkage occurs in this material and all of these operations are done under local anesthetic, with its resultant temporary retraction of the inferior turbinate, one should guard against a tendency to employ too thick implants. As stated before, in my earlier cases this occurred, and when the turbinate returned to its normal condition on the following day, I discovered that I had too narrow space for normal breathing. Thereafter I was very careful not to employ too large pieces and this objection was easily overcome.

The implants are sterilized by boiling, as this in no way injures or roughens them. A small incision is made in the mucocutaneous border and the mucoperichondrium is carefully dissected as in an ordinary submucous resection. Special care must be taken to preserve the entire flap, for if a tear occurs at any point there is a great likelihood of an infection resulting, necessitating the removal of the implant. Every effort must be made to dissect as close to the floor as possible, for the greatest amount of atrophy usually occurs at this point.

The implants are then slipped through the opening, and as this is in the skin, there is but little danger of tearing the flap. I usually employ three implants but occasionally only two. It is not necessary to sew the wound, but this may be done if preferred. I place a small Bernays splint over the incision and remove this on the following day. One is astonished at the small amount of reaction ensuing, for upon inspection of the nose during the next few days one sees only a slightly reddened mucosa with no edema or exudate.

Within twenty-four hours an improvement on the operated side is noted, as there is but little secretion and no crusting or odor, while the unoperated side presents the usual picture. The one symptom of which the patient complains is stuffiness, not any real obstruction, but only comparative, as the operated side is now narrow, while the other is still wide. This improvement continues with a gradual diminishment of the secretion, so that in a few weeks a physiologic cure has resulted.

Thus far I have only operated upon one side, being fearful of a loss of the cartilage. In one of my earlier cases, I attempted the second side, but to my chagrin and surprise, the anterior portion of my cartilage had been absorbed. In this patient the implant was not perforated, and an exceptionally large piece had been employed, which might easily account for the absorption of the cartilage. I have not as yet attempted a second operation in any of the cases where perforated implants were used, but I have examined them repeatedly, and apparently the cartilage is still intact.

I have had two cases in which it was necessary to remove the implants, as they had sloughed through the mucoperichondrium and could be easily seen, but in both of these the edges were sharp, and three large pieces had been used, so that there was a marked tension on the mucous membrane.

What will eventually become of all these cases I am at a loss to state at this time. That the implants will not become absorbed I am reasonably sure, but whether in another year or two they will slough out is a possibility. Will these small perforated implants cause an absorption of the cartilage? At present I am unable to answer this, but I predict that it will not occur.

In cases of socalled unilateral atrophic rhinitis—i. e., where there is a marked deflection of the septum to one side and practically no symptoms on that side—this operation will always be indicated, whether the cartilage is absorbed or not—i. e., providing the future shows us that the implant will not slough out.

In my series thus far, practically all my patients are delighted with the unilateral results and are anxious to have the other side operated on, but, preferring to err on the side of caution, I am biding my time.

CONCLUSIONS.

1. The etiology of atrophic rhinitis is unknown and thus far the treatment has been unavailing.

2. The symptoms persist unless the abnormally large intranasal space is materially lessened.

3. By intraseptal implant of ivory, this space can be lessened and consequently the symptoms must disappear.

4. It is only a question whether the perforated implants will remain in situ or slough out, and time, and time alone, will solve this question.

XIX.

ADDRESS OF THE PRESIDENT, AMERICAN BRONCHOSCOPIC SOCIETY, 1926.

By William B. Chamberlin, M. D.,

Cleveland.

It is needless to dwell on the appreciation which one must feel on being elected to the presidency of this, the American Bronchoscopic Society: a society which has exercised, and bids fair to continue to exercise in the future, so marked an influence on one of the most interesting branches of our specialty. For this honor which you have conferred upon one of the least worthy of your members, I wish to express my heartfelt thanks and appreciation.

Election to the presidency of this, or any similar society, carries with it not only an honor to the incumbent but certain penalties as well—not the least of which is the writing of a presidential address. The members also have inflicted a certain penalty upon themselves, for they, in turn, must listen to this address, inconsequential though it may be. Were I an explorer and could lead you through the devious windings of some hitherto unexplored tunnel and into the mysterious beyond; or a philologist, to startle you with one or more additions to your meager medical vocabulary, apologies would not be in order or necessary. Such, unfortunately, is not the case and you needs must listen, not to the grand old masters or even to the bards sublime, but to an humble aspirant.

The history of the development of our specialty has been most exhaustively and ably treated, first by our second president, Dr. Hubert Arrowsmith, and still later by our past president, Dr. Ellen Patterson. Since the presentation of Dr. Patterson's paper, probably the most interesting and valuable addition to our armamentarium has been the directoscope of Haslinger. This instrument bids fair to supplant the suspension laryngoscope of Killian. Although it by no means supplants the direct laryngeal speculum, it is a most valuable substitute in certain selected cases. A recent case will serve as

an illustration. A sewing needle, 3¾ cm. long, had become firmly embedded in the larynx of a woman, 30 years of age. The shaft of the needle transfixed the left arytenoid cartilage, while the eye projected about 1 cm. beyond the posterior surface of the arytenoid and into the posterior pharyngeal wall. The needle pointed obliquely forward and downward, the point being imbedded in the anterior tracheal wall, beneath the level of the anterior commissure. Under examination by the indirect method, the needle could be plainly seen—no X-ray picture being necessary. The directoscope was carefully introduced, the beak of the instrument carrying the epiglottis and larynx forward, while the vertebral plate freed the eye from its buried position in the posterior pharyngeal wall. The instrument was then held in position by an assistant, thus freeing both hands of the operator for bimanual manipulation. After several unsuccessful attempts, due to the firm impaction, the needle was finally grasped by the shaft, immediately above its eye, and withdrawn intact. The procedure was accomplished under local anesthesia.

Therapeutically the most valuable addition to our procedures within the past year would seem to be the use of lipoidal injections in the diagnosis and treatment of lung abscesses.

Under the direction of Dr. Elliott C. Cutler, professor of surgery in Western Reserve University, Weidlein and Schlueter have carried on, in the laboratory of Lakeside Hospital, an interesting series of researches in the experimental production of lung abscesses in dogs. They failed absolutely in their attempts to produce lung abscess by the introduction of foreign bodies or infectious material directly into the bronchi, but were able in 12 out of 17 attempts to produce a definite lung abscess by the introduction of an infected embolus directly into jugular vein. This embolus is prepared as follows: "The femoral vein is isolated, its branches are ligated, and a segment 12 to 18 millimeters long is removed. One end of this segment is ligated with silk. The other end is held open by three silk sutures. Into the lumen of this small segment of vein, an emulsion of bacteria is introduced by a platinum loop, together with one or two small bits of lead, previously coated with paraffin so as to render them inert. A drop of blood is then added and the second end tied. The small bits of metal

are added in order to study roentgenologically the final resting place of the infected embolus." This infected thrombus is then introduced into the jugular by means of a glass cannula and a large syringe filled with salt solution.

Although these experiments on dogs by no means settle the controversy as to whether lung abscess in man arises through the air passages or through the blood and lymph channels, they offer a valuable and interesting contribution to the subject.

During the year there have come to our clinic at Lakeside Hospital several cases which, to me at least, have presented more than passing interest. A man, 28 years of age, was seen two months previously by one of my colleagues. At that time he presented a growth beneath the inner end of the right clavicle. Two weeks before my examination, he began suffering with an inspiratory dyspnea of increasing severity. Indirect examination showed a complete paralysis of the right vocal cord. Bronchoscopy under local anesthesia showed a growth 1 by 2 cm. in diameter, projecting from the right tracheal wall, 20 cm. from the teeth. The growth was removed as completely as possible. Microscopic examination showed it to be a carcinoma. Whether the growth in the trachea was primary or secondary is a matter of conjecture. At that time the esophagus was not involved. The patient died of cachexia and complete esophageal obstruction three and one-half months after the examination.

A woman, aged 67, had been successfully operated upon 18 months previously for malignancy of the thyroid. Four days before the examination she developed a dysphagia of increasing severity. X-ray examination was unsatisfactory. The patient was short and stout, weighing some 160 pounds. Some doubt was felt in regard to the ability to pass the esophagoscope successfully under local anesthesia; yet no great difficulty was experienced. The patient was extremely nervous, however, while her pulse rate went up to 160 during the examination. At a distance of 32 cm. from the teeth, there occurred marked bleeding, which was ultimately controlled by adrenalin. A tumor mass, 1 by 2 cm., was now discovered projecting from the right esophageal wall. This tumor mass was apparently sessile, but was freely movable. On account of its firmness and the previous hemorrhage, it was not thought

wise to remove a piece for microscopic examination. She left the table in good condition at 3 p. m. During the evening she experienced some pain and received ½ grain of codein at 8 p. m. and ⅛ grain of morphin at midnight. At 4 a. m. the nurse visited her room and found her complaining of some distress. On the return of the nurse some ten minutes later the patient was dead. An autopsy could not be obtained.

The three following cases are of interest in that two of the three cases were referred to the hospital with a diagnosis of foreign body in the esophagus, while the third case presented somewhat similar symptoms.

Case 1.—A boy, 9 years of age, had an attack of vomiting two weeks previously. There was no subsequent malaise until two days before examination, when he suddenly became unable to swallow and fluids regurgitated through his nose. The temperature on reaching the hospital was 104. There was some difficulty in speech. Indirect examination showed both cords freely movable but some fluid in the pyriform sinuses. X-ray examination with the bismuth meal showed a complete stoppage at the level of the larynx. The patient died at 2 o'clock of the following morning. A diagnosis of anterior poliomyelitis was made at the time of the examination. This diagnosis was confirmed by autopsy.

Case 2.—A child, seven years of age, complained of not feeling well and was first seen by the family physician 24 hours later. At that time the physical examination was negative except for a slight twitching of the left eye. Castor oil was administered by the parents but was vomited some 30 minutes later. She also had some difficulty in respiration. At the subsequent visit of the family physician, four hours later, there was great difficulty both in respiration and deglutition, accompanied by a constant discharge of mucus from the mouth. A diagnosis of foreign body in the larynx was made and the child referred to the hospital. She died in the ambulance before the hospital was reached. The subsequent diagnosis was acute anterior poliomyelitis.

Case 3.—Boy, 10 years of age, was first seen by the family physician five days after an illness which began with a sore throat and was followed by malaise and some swelling of the cervical glands. On the previous day there had been some

nausea as well as some complaint of the throat. In the morning the child had arisen but had felt too ill to be up and returned to bed. On examination the throat was found to be mildly injected, the neck slightly rigid. There was also some nausea. Temperature 102, pulse 120, respirations 28. On subsequent day there was extreme restlessness, followed by vomiting of blood, inability to swallow and loss of voice. Temperature 104. The vomiting continued at intervals of four hours until his death, twelve hours later. Diagnosis: Anterior poliomyelitis.

I cannot bring this socalled address to a close without asking the other members of this society to join with me in paying tribute to one of our fellow members for his disinterested efforts in the cause of humanity. In his now famous article in the January number of the Atlantic Monthly for 1926, Mr. W. Z. Ripley, professor of economics at Harvard University, speaks as follows: "One of the most encouraging things in life is the influence that can be wielded by an individual, acting almost single handed and alone, to confront and often to overcome a corporate Goliath, provided he has the right on his side. My mind runs to the extermination of the Louisiana Lottery by a former colleague, Professor Homer Woodbridge: think of it—professor of heating and ventilation at the Massachusetts Institute of Technology. Or recall what Charles and Philip Cabot achieved in bringing about the elimination of the seven day week and the twelve hour day in the United States Steel Corporation. Or Lois Burnett Rantoul, undauntedly facing down every corporate influence in the Massachusetts Legislature and bringing about the enactment of the first eight hour day law for women and children in the United States. Such things as these give one good heart, leading to the belief that the power of personality alone may win the most astonishing victories in the face of overwhelming odds." Surely these achievements have their counterpart in the efforts of one of our members. Practically through his efforts alone, legislation requiring the proper labeling of caustic alkali, a poison, has been enacted by the Senate of the United States and by fourteen of the individual states of the Union. I know you will all join with me in bestowing my congratulations upon Chevalier Jackson, one of the founders and the first president of the American Bronchoscopic Society.

XX.

BRONCHOSCOPY IN THE GENERAL HOSPITAL.*

By M. C. Myerson, M. D.,

Associate Laryngologist, Mt. Sinai Hospital,

New York.

It is almost thirty years since Killian first demonstrated successful bronchoscopy. Since then bronchoscopy has reached a high state of perfection. It would seem that the medical profession has not taken as much cognizance as it might of the procedure during this long period of years. This is so despite the efforts of Jackson and a few others. Bronchoscopy has been developed to its present degree of perfection especially through the continued and untiring teachings of Jackson. It would now seem timely for those interested in endoscopy to put forth some effort in advancing its recognition as a valuable routine procedure in daily hospital practice.

One is impressed with the scarcity of articles by bronchoscopists which deal with medical conditions. These conditions must necessarily be referred from the medical services in our hospitals. The hospital where bronchoscopy is regularly performed is the exception. In the following paragraphs the writer will endeavor to show how recognition can be obtained for bronchoscopy in the general hospital. By the interest and perseverance of the individual a fairly large number of bronchoscopic cases can be seen in consultation with other services, so that in time bronchoscopy will become an accepted and integral part of the activities of the institution. In the hospital which serves as my example in this paper, bronchoscopy is so regularly and so frequently performed, that each interne is well acquainted with the procedure, its indications, its contraindications and its possibilities from a therapeutic and a diagnostic standpoint.

Until twelve years ago endoscopic procedures at the Mt. Sinai Hospital were restricted almost exclusively to foreign

*From the Department of Laryngology, Mt. Sinai Hospital.

body cases. At this time Dr. Yankauer became interested in the lung suppurations which were beginning to come to the attention of the profession. He sought material from the medical services so that he might put into practice his ideas of irrigation and aspiration in this type of case. It was only natural that he should meet with skepticism, hesitancy and refusal. Until one day it was decided to refer a patient with a lung suppuration for bronchoscopy. What could have been more opportune than that Dr. Yankauer should bronchoscope the patient and encounter a foreign body? The removal of the foreign body from one of the main bronchial branches brought about a fairly rapid and complete recovery. This experience so impressed the medical services, that from that time on lung suppurations, and gradually also obscure chest conditions, were referred to the nose and throat department for endoscopic study and treatment.

As time went on, equally impressive experiences have led the internists to be ever mindful of the place of bronchoscopy in the everyday diagnosis and care of their patients' conditions. As a result, a comparatively large number of endoscopies are being performed by the nose and throat staff of the hospital. Bronchoscopy is considered a part of the routine work of this department. One day a week is set aside especially for this work. Occasionally one or more patients are cared for on days other than the bronchoscopic day. During the six months beginning August 1, 1925, and ending February 1, 1926, the department of laryngology performed 343 endoscopies. These 343 endoscopies were performed upon 128 different patients.

The 343 endoscopies included:

Bronchoscopies	313
Esophagoscopies	16
Laryngoscopies	9
Gastroscopies	4
Tracheotomic bronchoscopy	1

The gastroscopies were performed by Dr. Kramer, who is interested in this procedure.

Of the 128 patients, 37 were cases of lung suppuration. Of these 37, 23 were referred from the medical services, while

the remaining 14 were chronic cases who came at intervals of a week or longer for treatment.

Of the 128 patients, 93 were referred from the medical wards. It is of interest to note that only 6 of the 128 patients were referred directly for the removal of a foreign body.

Endoscopies were performed for the following:

According to condition—
Asthma.
Bronchial stenosis.
Esophageal stenosis.
Lung suppuration.
Lung tumors, bronchial.
Lung tumors, extrabronchial.
Mediastinal neoplasm.
Mediastinal infection.
Tracheoesophageal fistula.
Tuberculosis.
Unsuspected foreign body.
Sarcoma of the thymus.
Foreign body trachea.
Foreign body bronchus.
Foreign body esophagus.
According to symptoms or signs—
Hemoptysis.
Hematemesis.
Unexplained cough.
Obscure physical signs.

I will not attempt to give details of all the cases in this study. Detailed reports of some of the unusual cases or of series of cases will be the subject of a future paper. It might, however, be of interest and of value in connection with this paper to briefly cite some of the cases that might be considered unusual.

Case 1 (H. M.), Unsuspected Foreign Body in the Bronchus.—A boy, aged 19 years, was referred from the medical service with a history of weakness and hemoptysis of three years' duration. He was bronchoscoped by Dr. Yankauer, who found the lower part of the left lower lobe bronchus filled with a mass of granulation tissue which bled easily. A piece of the shell of a nut was found in the center of this granulation tissue and was removed. (To be reported later.)

Case 2 (G. T.), Perforation of the Esophagus.—A boy of 12 years was referred for esophagoscopy and bronchoscopy from one of the medical services with the following story. While eating supper five days before, he experienced a choking sensation. Immediately after he noted a sharp pain in the chest. Pain was aggravated by breathing, and constantly present. He could not sleep. For the past two days he had had chills, fever and sweats.

At bronchoscopy Dr. Yankauer found the bronchial tree free from any abnormal lesion.

Esophagoscopy revealed a perforation 2 mm. in diameter, 24 cm. from the upper teeth. Air and pus were seen to come from this perforation during the respiratory movements. Smear and culture from this area showed the presence of hemolytic streptococci. A bent probe could be passed into this opening. No foreign body was seen. The boy died fourteen days after admission.

Autopsy revealed the perforation previously noted, a septic thrombosis of the vena azygos major, multiple lung abscesses and a bilateral empyema. (This case will be reported in full).

Case 3 (J. B.), Case of Unsuspected Tuberculosis.—A man, aged 23 years, was referred for bronchoscopy from one of the medical services. He had what they believed to be a "non-tuberculous infiltration of the left lower lobe. He coughed slightly, there was no expectoration, and no evidence of lung suppuration." Sputum was repeatedly negative for tubercle bacilli. At bronchoscopy there was found a marked dilatation of the left lower lobe bronchus—the mucous membrane was pale. There was a very slight amount of mucous secretion. Opinion was given that the condition was a left lower lobe fibrosis with bronchial dilatation.

Immediately after bronchoscopy the sputum was found to contain tubercle bacilli in large numbers. This occurred after repeated negative findings for a whole month. This patient was admitted as a case of unresolved pneumonia with intermittent temperature ranging between 99 and 103. This was an unsuual case of tuberculosis, where roentgen ray and clinical signs persisted at the lower lobe, and where bronchoscopy caused the appearance of the tubercle bacilli in the sputum before there was evidence of apical involvement.

Comment.—It is not felt that the tuberculous process was activated by the bronchoscopy. It is felt rather that the straightening out of the bronchial elements liberated the pent up organisms into the lumen of the bronchus, from which they were expelled.

As has been indicated before, the fact that there are not more papers on medical conditions by bronchoscopists is evi-

dence that the bronchoscopist is not receiving the support of his colleagues in most medical groups.

It is unfortunate that most physicians are still so indifferent to the value and advantage of endoscopy, despite the splendid missionary work that has been done by the pioneers in this field. Bronchoscopists should accept every opportunity to make known how endoscopy can help in the diagnosis and treatment of disease. They should make known the indications and contraindications of these procedures to the profession, so that when suitable cases present themselves bronchoscopy will be thought of. We should warn against the unskilled and inadequately prepared. After short courses, which should be considered preliminary and preparatory, they buy equipment and proceed to perform endoscopies. In this manner they jeopardize the acceptability of bronchoscopy to the profession at large. One can understand the skepticism and hesitancy of the medical man who has witnessed unskilled endoscopy. I am convinced that the average physician is converted to the desirability and real value of bronchoscopy when he has seen it performed properly. Bronchoscopy should find recognition in every general hospital.

DISCUSSION.

Dr. William B. Chamberlin: We have to thank the efforts of Dr. Orton, and of Dr. Clerf, acting secretary, for the success of the ninth annual meeting of the Bronchoscopic Society. This is one of the few times I have seen Dr. Mosher keeping to the rear of the auditorium. I will ask him to come forward and escort the new president, Dr. D. Crosby Greene, to the chair.

Dr. D. Crosby Greene, Boston: I am very sensible of the honor you have done me by this election. I hope future meetings will be as productive of real contributions to this special line of laryngology as this meeting has been. I will declare this meeting adjourned.

Dr. M. C. Myerson (closing): The consultants are the heads of the medical services in the various hospitals. If the general practitioner recognizes this work it is because the

heads of the profession take it up with a zest. If the heads of departments of hospitals take an interest in bronchoscopy, the general practitioner will fall in line. The work should be popularized in the local medical societies, but you should also do missionary work in your own hospitals, and interest the heads of the medical departments in the diagnostic and therapeutic possibilities of this work.

XXI.

BRONCHOSCOPIC PHARYNGEAL SUCTION TUBE.

By M. C. Myerson, M. D.,*

New York.

This pharyngeal suction tube is designed to remove the accumulation of mucus and saliva, and sometimes pulmonary exudate or esophageal secretion, which finds its way into the pharynx during bronchoscopy or esophagoscopy.

The sudden shifting of the patient from a prone to a sitting position after the withdrawal of an endoscopic tube has nothing to commend it.

The presence of the pharyngeal suction tube during endoscopy relieves the moderately sick or very sick individual of a good deal of heretofore unnecessary discomfort. This tube will have its greatest usefulness in esophagoscopy, where the pharynx is prone to fill up with mucus and saliva more readily than in bronchoscopy.

The shape of the tube is such that it can be placed upon the posterior pharyngeal wall and held there during the bronchoscopic or esophagoscopic procedure. When the endoscopy has been completed, the patient is simply slid back upon the table. There is no sudden sitting up with thick mucus, sometimes mucopus, streaming out of the mouth and at times the nose also. The impression that a visitor must get after witnessing a bronchoscopy or esophagoscopy, when he sees the patient suddenly pushed into a sitting position with the thick secretion or exudate, or both, streaming from his mouth and nostrils, is not conducive to the development of bronchoscopy. In most clinics these patients are placed in a sitting position and are at the mercy of the kindness or efficiency of the individuals in attendance for a towel with which to wipe the face, or a pus basin to expectorate into.

30 East Fortieth Street.

*Associate laryngologist, Mt. Sinai Hospital.

Pharyngeal Suction Tube.

XXII.

A NEW ESOPHAGEAL BOUGIE.

By M. C. Myerson, M. D.,*

New York.

This esophageal bougie was designed to simplify, if possible, esophageal dilation in cases of stricture. Most of the bougies at present available for esophageal dilation are made of fiber and therefore cannot be boiled. Furthermore, they cannot be threaded, and when resistance is encountered the end of the bougie very frequently breaks. It was, therefore, thought that a bougie which would best answer our requirements should have the following advantages:

1. It should be of all metal, so that it can be boiled.

2. The construction of the bougie should be such that if any undue resistance is encountered, the bougie will curl up on itself rather than cause a false passage.

3. The bougie should have an opening through it, so that it can be threaded over a previously swallowed string.

4. The bougie should be unbreakable.

These requirements seem to be met in this instrument. I have suggested that the bougie be made in nine sizes (12, 16, 20, 25, 29, 33, 37, 41, 45), so that dilatation can be accomplished up to a 45 French measurement. The advantage that this instrument seems to have over others is that it is almost impossible to make a false passage; the bougie end being of flexible spiral wire will coil up on itself before it will force a false passage. I would strongly urge that all esophagoscopic bouginage be performed over a previously swallowed thread, as originally suggested by Plummer. With a previously swallowed thread such a bougie would be of real advantage. The previously swallowed string can be readily threaded through

*Associate laryngologist, Mt. Sinai Hospital.

the bougie with the aid of a piece of silkworm gut or fine gauge snare wire.

Mention should be made, and due credit given to the existence of the Plummer-Vinson bougies, which at the present time seem to fulfill the above requirements best. However, there is an advantage in having each bougie a single and separate instrument, while the degree of resistance in the bougies here shown is much less.

30 East Fortieth Street.

XXIII.

MULTIPLE CYSTS OF THE LUNG.*

By William Frederic Moore, M. D.,

Philadelphia.

Multiple cysts of the lung may be either congenital or acquired.

Dr. Amos R. Koontz[1] gives a very comprehensive report of 108 socalled congenital cases, including diverticula of the trachea or main bronchi, solitary cysts of the trachea or bronchial wall, cysts of aberrant lung tissue and accessory lobes. There is a great diversity of opinion as to the causation of this condition, but, as Dr. Koontz points out, "its early origin in some cases which have come to post, is seen in patients who have reached maturity, who have a lack of pigment in the congenital lesions, showing that the affected part of the lung had never functioned and that, therefore, the pathologic condition antedated birth."

ACQUIRED CYSTS.

British literature, from 1887 to 1905,[2 3 4 5] is rich in reports of hydatid cysts of the lung, which may be either single or multiple. The lung may be involved by rupture from adjacent structures or be the seat of primary involvement. The diagnosis cannot be definitely established unless the cyst ruptures, and symptoms may continue over a period of years, as in the case reported by Archangelsky, where looplets, scolices and portions of cyst membrane were coughed up after an observation period of six years. The history of cysts of the hydatid variety shows that there is a tendency to spontaneous rupture either into the pleural cavity or into a bronchus. This occurs relatively in a limited time, as a general rule.

Lendon[5] believes that when degeneration of a cyst has been found at postmortem the hydatid has not been suspected during life. Almost all the reported cases show the tendency to-

*From the Bronchoscopic Clinic, Jefferson Hospital, Philadelphia.

ward growth and subsequent rupture in a relatively short period of time.

Quoting from Sydney Smith[6]: "The presence of mucoid or colloid matter in many of the cysts indicated that secretion from their walls is fairly active, and if, as suggested by the microscopic sections, there was some inflammation of the bronchioles, which caused blocking of their lumen, this would account for the retention of their secretion and dilatation from consequent pressure."

Cauley[7] mentions in his interesting case the possibility of an earlier communication between cyst and bronchus, and that the onset of symptoms was due to a closure of the orifice. Air may have been able to enter and was prevented by a valve-like opening from escaping, thus causing gradually increasing pressure and a fatal issue.

Hydatid cysts are rare in children, being most often found between the ages of 20 to 40 years.

Devé, quoting from Abt,[8] insists that the infection is contracted during infancy or childhood, and that in those cases in which it does not manifest itself until the third or fourth decade of life, the condition has remained latent. Devé's point is important, since the hydatid cyst of ages up to 15 years is usually a simple cyst, which is much more amenable to surgical treatment than the complicated, often infected, cysts of later years, with their numerous daughter and granddaughter cysts.

A sign which may be indicative of either a localized bronchiectasis or direct communication of the cystic cavities with a bronchus has been noted. During bronchoscopy and with the bronchoscope in position at the bronchial orifice the patient flexes the knees on the abdomen and endeavors to increase the intraabdominal pressure, thus lifting and contracting the diaphragm. During this maneuver an increased amount of secretion was seen at the bronchial orifice.

We believe that a localized bronchiectasis may exist beyond the cysts and that increased intrathoracic pressure presses out accumulated material. We have no reason to believe that these cysts communicate directly with a bronchus.

The case which we wish to report has been under observation for over two years, and there has been only a very slight increase in size in that time. It is highly probable that these cysts may be congenital, because the history of a productive cough is rather vague, and we believe that symptoms of a localized bronchiectasis may have developed slowly only as increased pressure was exerted on a bronchus or bronchi.

HISTORY.

M. J., age 37, white, came to the Bronchoscopic Clinic November 9, 1923.

The personal history was as follows: Has had measles, scarlet fever, chickenpox and whooping cough in childhood. Diphtheria in March, 1907. Mumps one month later, complicated with epididymitis. Two years ago, typhoid fever. In 1918, an attack of influenza. Diseased tonsils removed three years ago, following an attack of tonsillitis.

Present illness: Cannot date actual onset, but says there was a gradual onset following winter colds, tonsillitis and la grippe, dating back six or seven years, though he believes that symptoms such as raising secretion when he coughed antedated even this.

Symptoms: Productive cough, both day and night, with the raising of yellowish, blood tinged sputum. Cough seems to be caused by secretion which "rattles chest." Air moves easier in left side than right. Expectoration of about two tablespoonfuls a day of pus which he says has a musty odor.

Family history: Sister was operated on for abdominal dermoid cyst about two years ago. No history of tapeworm or the removal or warts or moles.

Examination: Physical examination by Dr. E. H. Funk, November 9, 1923, showed the following: "Well nourished adult. The general physical examination shows nothing of note. The finger nails show no clubbing. Chest examination reveals slight limitation of expansion in the lower half on the right side. In the lower axilla and about the angle of the scapula, on the same side, the breath sounds are less intense than on the right side. A few squeaking räles are heard.

Diagnosis: Localized chronic bronchitis, with some fibrosis; no bronchiectasis.

I would suggest bronchoscopy for a diagnosis and perhaps treatment. I do not believe bronchoscopy for drainage is necessary, since there seems to be no great discharge or any particular blocking of the discharge. I do not believe the man has tuberculosis, although there are a few signs at the top of the right lung suggestive of an obsolete lesion. Bronchovesicular breathing with a slight increase in the transmission of the voice."

On July 2, 1924, Dr. Funk made the following observations: "There is very little change in the physical signs referable to the chest, except the clearing of räles. There is slight limitation of expansion in the lower portion of the right chest. High pitched percussion note and distant breath sounds continue to be definite. Apices are clear. Heart examination shows nothing of note. The abdomen is soft—no localized rigidity, tenderness or masses. Liver margin palpable below costal margin on right side. Spleen is not palpable. Right incomplete, reducible hernia. Right testicle soft and atrophic. I have noted the recent X-ray study of Dr. Manges and the recent bronchoscopic reports of Dr. Moore. I am somewhat at a loss to explain the cyst formations which are evident in the X-ray examination. There is a remote possibility that this may be hydatid cysts. It would be interesting to obtain a blood examination with special reference to the presence of eosinophilia. The general condition of the patient seems improved."

The roentgen ray examinations of Dr. Willis F. Manges cover a period from November 22, 1923, to May 13, 1926, and are as follows: "There is a most unusual condition in the chest of this patient. There are three or four apparently separated, sharply defined, irregularly rounded masses in the middle lobe on the right side, that have a density that suggests either fluid, pus or solid tissue. They are entirely unlike anything that I have ever seen before. In addition to these sharply defined masses there is also a definite peribronchial thickening extending into the lower lobe and surrounding density that leads me to believe that it is in the nature of an inflammatory process with considerable exduate. The sharply defined masses may be cavities fully extended with exudate—I should think bronchiectatic rather than abscess—but I am by no means able to

rule out the possibility of their being something in the nature of a growth or cyst of some kind."

On February 14, 1924, Dr. Manges made the following report: "The lesions in the right middle and lower lobes are now very much more sharply defined and perhaps definitely smaller than on the former occasion. I think, too, there is a little less density present."

On April 24, 1924, he reported: "There is practically no change since the examination in February, but there was less evidence of inflammatory changes in the lung tissue beyond and back of the masses."

On April 29, 1926, Dr. Manges reported that the masses in the right lower chest seemed a little larger than they were formerly—there was some cloudiness in the distribution of the posterior branch of the right lower lobe bronchus. "At the same time I think the individual mass is less dense than it was."

Of a lateral view taken May 13, 1926, Dr. Manges made the following report: "A lateral view indicates that these cystic like areas are in the interlobar pleura between the lower and middle lobes—at least, they have that distribution."

Repeated blood examinations by Dr. George R. Moffitt have shown no abnormality beyond a very consistent eosinophilia of 7 per cent.

Examination of the stools revealed no ova or parasites.

Sputum examinations for tubercle bacilli have been negative on three successive examinations.

At the first bronchoscopic examination, November 9, 1923, the following was noted: Mucous membrane of trachea as far as carina injected and covered with a thick tenacious pus. Left main stem bronchus normal. The pus apparently became more liquid as the bronchoscope was inserted in the right main stem bronchus. The orifice of the upper lobe bronchus normal. The orifice of the middle lobe bronchus secreting no pus. From the lower lobe bronchi, and especially most pronounced from the external branch, a fluid pus exuded, drop by drop, when the patient coughed. A fold of membrane partially blocked the internal branch. This was thought at first to be a real ob-

struction, but disappeared on deep insertion of the bronchoscope. Specimen secured for laboratory examination. Diagnosis: Pulmonary suppuration localized in right lower lobe.

An analysis of subsequent bronchoscopic examinations brings out the following interesting data: This case has been bronchoscoped 87 times since December 9, 1923. During this time, following the first bronchoscopy, changes were noted from time to time. Secretion was found coming from the orifice of the middle lobe bronchus on July 2, 1924. The orifice was diminished. Whether this was due to pressure from surrounding tissues or not, the indications were for dilatation. This was done on two occasions. Twenty per cent gumonal was injected into the bronchus. At no time since these treatments has any abnormality been noted at this orifice.

An attempt was made to develop a bacteriophage, but this was unsuccessful because the staphylococcic infection was eliminated and difficulty developed which was found insurmountable with the streptococcus. Three different courses of vaccine made from material taken from the affected bronchial orifice were administered. Irrigation with a solution containing: Trinitrophenol, gr. 2; Lugol's solution, dram 1; normal saline solution, pints 2, was tried. Colloidal silver preparations, such as "arkase," gave a decided reaction when injected into the bronchus, and were abandoned in favor of a 20 per cent solution of gumonal, which is being injected at the present time.

The attempt has been made in this case to secure good drainage for a suppurating area with the instillation of healing medicaments. While the patient is not cured, the clinical picture is one of marked improvement. He came to us because of a productive cough. Both the cough and expectoration have been decreased to about one-sixth of their former amount.

CONCLUSIONS.

1. The long duration and the absence of other findings which might prove these cysts of the hydatid variety makes it highly probable that this case may be congenital.

2. Without an actual communication between a bronchus and the cyst, evidence of suppuration may be found at bronchoscopy due to pressure bronchiectasis.

BIBLIOGRAPHY.

1. Koontz: Congenital Cysts of the Lung. Bulletin Johns Hopkins Hosp., Nov., 1925, Vol. 37, p. 340.
2. Bird, F. D.: Melbourne Medical Journal, 1874.
3. Miers: Australasian Med. Gazette, Nov., 1892. Coates, Proceedings Royal Society of Med., 1922-23, XVI, Clinical Sec. 28.
4. Bird, F. D.: Medical Journal, Australia, Oct., 1925.
5. Lendon, A. A.: Clinical Lecture, Hydatid Diseases of the Lung.
6. Smith, S.: British Medical Journal, May 30, 1925.
7. Cauley: British Journal Diseases of Children, 1924, p. 38.
8. Abt's Pediatrics, Phila., 1924, 33-59.
Elvesser: Archives of Surgery, 1925.

XXIV.

CONTINUOUS ENDOBRONCHIAL ASPIRATION FOR DROWNED LUNG COMPLICATING ECLAMPSIA.*

By William F. Moore, M. D.,

Philadelphia.

Case 1.—A. R., female, white, after having been thoroughly studied in the prenatal clinic at St. Mary's Hospital, Philadelphia, Pa., was, on May 14, 1926, admitted for delivery—at this time having contractions of the uterus. Temperature was 99 3/5. She developed symptoms of eclampsia, the onset being characterized by nausea and vomiting, with severe headache.

During the day of May 14, 1926, pains were recurring at five minute intervals. The respirations were above twelve, and convulsions were coming on at twenty-minute to one-half hour intervals—were very severe and lasted from three to twelve minutes. At 9:40 patient was taken to the delivery room. During the day she had received almost a grain of morphin sulphate hypodermically. Symptoms of pulmonary edema rapidly developed, with impaired resonance and bubbling räles over both lungs at the bases, both anteriorly and posteriorly, with a coughed up expectoration of frothy blood tinged serosanguinous material. With the aid of a Jackson direct laryngoscope, a tube for permanent drainage was inserted into the trachea as far as the carina without difficulty. This was attached to an ordinary suction machine and retained for one-half hour. At this time about 15 cc. of frothy thick mucus was removed. There was no embarrassment of respiration and the convulsions were not increased in severity or frequency.

During a low forceps delivery the tube was temporarily removed, but again inserted for fifteen minutes, at which latter procedure 10 cc. of fluid of the same character as before was removed.

*From the Bronchoscopic Clinic, Jefferson Hospital, Philadelphia.

NOTES.

Räles, coarse and bubbling, at both bases before starting drainage.

Reflexes were entirely abolished.

No coughing during introduction of aspiratory tube or when in place.

In the midst of the last insertion there was a severe convulsion, lasting four minutes. This in no way interfered with the position of the tube nor was breathing embarrassed.

The color remained good.

Fluid aspirated was serous, containing many cylindrical epithelial cells; few white and red blood cells; alkaline in reaction.

COMMENTS ON DRAINAGE, BY DR. J. S. LAWRENCE.

1. It is feasible and does no injury. Can be retained during a convulsion.

2. Fluid is removed, and the heart, especially the right side, is relieved of strain.

3. From the moment that the aspiration started, the pulmonary edema came under control and did not threaten at any later time to embarrass respiration.

4. Repeated examinations of the chest were made for five days following the procedure, and the facts stated above are based on these examinations.

CONCLUSIONS, BY DR. J. S. LAWRENCE.

Bronchoscopic aspiration is a feasible and the most reliable method of managing pulmonary edema in eclampsia.

DISCUSSION.

DR. SEYDELL: I saw two children who were rescued from a burning building and brought to the hospital who later developed edema of the lung. The one case was unconscious when brought to the operating room. The aspirating tube was passed through the larynx with the aid of a direct laryngoscope and a large amount of frothy fluid was aspirated from the lung. The child immediately regained consciousness. Although it was necessary to repeat the aspiration treatments a few times, both children made an uneventful recovery.

XXV.

BRONCHOSCOPIC LIPIODOL INSTILLATION TUBES.

By Gabriel Tucker, M. D.,*
Philadelphia.

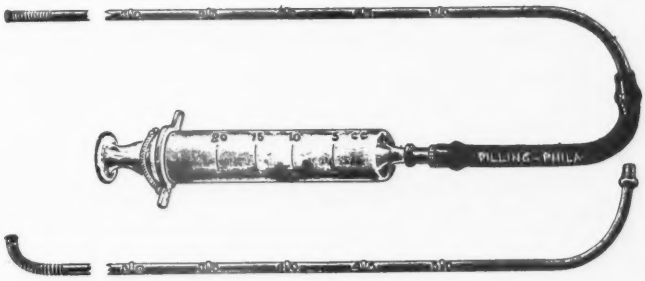
When lipiodol is to be introduced for pneumonography, it is very desirable, first, to have the portion of lung that it is desired to study as free of secretions as possible, so that the liquid can enter. Second, that the lipiodol be introduced into the main bronchi of the portion of lung under study and be allowed to find its way into the deeper portions of the lung without being forced in under pressure. The lung can best be freed of secretions by bronchoscopic aspiration. Following this, thorough cocainization is carried out; and, most important, the excess of solution is aspirated.

The instruments we wish to present are large caliber tubes with Lynah spiral tips, one with a straight Lynah spiral tip, and the other with an angular Lynah spiral tip, for getting around the corner in the upper and middle lobe bronchi. The lumen of the injecting tube is large, so that the heavy oil will pass readily through; and the proximal end is marked at 5 cm. intervals, so that the distance of the tip carried into the bronchus beyond the tip of the bronchoscope can be determined. The angular tip corresponds in direction to the handle end of the tube.

Rubber tubing is provided for the proximal end, with a metal connection for the standard Luer syringe. The tube is moved slightly in and out as the lipiodol is introduced, the patient being placed in the proper position for gravitation of the oil into the desired area of the lung. Thus the lipiodol goes into the deeper portions of the lung freely but not under pressure.

It is important to have a flexible connection between the instillation tube, which is held by the surgeon, and the syringe, which is in the hands of the nurse. This is provided in this outfit by connecting the tube and syringe with rubber tubing.

*From the Chevalier Jackson Bronchoscopic Clinics.



LIPIODOL INSTILLATION TUBE

XXVI.

A BRONCHOSCOPIC BEAD FORCEPS.

By Gabriel Tucker, M. D.,*

Philadelphia.

The removal of an impacted bead from the bronchus offers one of the most difficult problems that confronts the bronchoscopist. Many instruments have been devised for its solution. A number of the instruments are constructed for insertion through the hole in the bead, and in some types of beads these instruments have been successfully used. The disadvantages, however, are the difficulty in getting into the hole of the bead, involving risks of pushing it downward, and, in thin glass beads, of breaking.

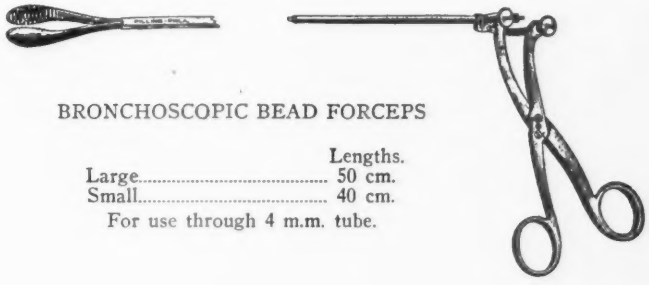
The principle of the forceps I wish to present is that of the heavy model standard Jackson stylette and cannula type that is universally used in bronchoscopic work. The bead forceps are intended to grasp over and distal to the greatest circumference of the bead in cross section as it presents in the bronchus. The forceps are provided with a stiff, expanding spring to enable the blades to repress the bronchial mucous membrane and find their way between the bead and the bronchial wall. The blades are tipped slightly toward each other so that when the forceps are fully opened the blades are parallel. The points are turned slightly inward at the tip, like a parrot's beak, and the width of the blade is cupped deeply to prevent lateral slipping; the cupped surface is provided with sharp teeth canted backward, as in the standard Jackson forceps, but the serrations extend down into and across the cup, to provide a firm grasp. This feature, along with the shape, enables the forceps to exert traction at a point distal to the greatest diameter of cross section.

In applying the forceps, it is introduced through the bronchoscope, by sight and sense of touch, until it is in contact with the presenting circumference of the bead. It is then opened

*From the Chevalier Jackson Bronchoscopic Clinics.

and advanced, the tips of the blades follow the surface of the bead, and the stiff spring presses back the mucous membrane until the greatest diameter of the cross section of the bead, as it presents, is in the center of the deeply cupped blades. The forceps are then closed firmly. The bead is drawn gently out of the bronchus into the trachea, then held firmly against the end of the bronchoscope, and the bronchoscope, forceps and bead are held together and brought out through the glottis as one piece, thus preventing stripping off at the glottis. The forceps have been successfully used by Dr. Jackson, Dr. Ellen J. Patterson and the other members of our clinic, as well as by myself.

The forceps are constructed in two sizes, the smaller to go through a 4 mm. bronchoscope.



BRONCHOSCOPIC BEAD FORCEPS

	Lengths.
Large	50 cm.
Small	40 cm.

For use through 4 m.m. tube.

XXVII.

REPORT OF TWO CASES OF AN OPEN SAFETY PIN IN THE TRACHEA.

By Henry Hall Forbes, M. D.,

New York.

The two cases presented by X-rays are of interest to the writer for several reasons.

First—The two cases occurred so near together—within a week of one another.

Second—The one, a child of five years; the second, an adult of thirty-three years.

Third—The very odd fact that the point in one case was posterior and the second anterior.

Fourth—That, notwithstanding the fact that one had been manipulated, the pins were in identically the same region in the trachea, both having been arrested in its upper end immediately below the cords—both discernible during inspiration, both lost when cords were in adduction.

Fifth—Their removal by direct laryngoscopy with no trauma or after effects.

Sixth—No change in voice of either patient; no dyspnea.

The X-rays are presented.

Case 1.—Female, age 5 years, was referred to the writer by Dr. W. Tracy of Norwalk, Conn., and was admitted to the New York Post-Graduate Hospital October 3, 1925. A few hours before admission she had "swallowed" an open safety pin. Attempts at removal by local surgeon failed. The X-ray showed a medium sized open safety pin, point upward, in the tracheolaryngeal region. Time of removal, second attempt, two minutes. General anesthetic.

Case 2.—Female, age 33 years. Referred to writer by Dr. Briggs of Mt. Kisco, N. Y., and admitted to the New York Post-Graduate Hospital a few hours after "swallowing" an open safety pin. The X-ray showed "medium sized open safety

pin, points upward, one point (sharp) posterior in the tracheo-laryngeal region."—Dr. W. H. Meyer.

Removal by direct laryngoscopy; local anesthetic. Time, two minutes.

I do not wish to bring up the old controversy of local vs. general anesthesia. You will note in one case the anesthetic was general and in the other local. It would be a wiser and safer course to use a general anesthetic for removal of sharp foreign bodies in children when the general condition will admit.

XXVIII.

REPORT OF THREE CASES: (a) FIBROMA OF THE LEFT BRONCHUS; (b) ULCER OF THE RIGHT BRONCHUS; (c) FOREIGN BODY IN THE TRACHEA AND RIGHT BRONCHUS.*

By Waitman F. Zinn, M. D.,

Baltimore.

The following cases are reported to show the importance of an endoscopic examination in obscure conditions referable to the tracheobronchial tree.

Primary fibroma of the bronchus, while not frequently diagnosed, occurs more often than was formerly thought. They are usually of slow growth and present for a long time before symptoms become pronounced.

Case No. 1.—M. A. Z., man, age 52 years, occupation undertaker, referred by Dr. R. Hoyt, October 8, 1925. He was admitted to Mercy Hospital complaining of loss of weight, general malaise, chills, sweats, dyspnea and paroxysms of coughing. His health during childhood had been good. At the age of 22 years he was critically ill with pneumonia, from which he entirely recovered. When 25 years of age he met with an accident, receiving severe injury to the left chest wall, from which he suffered for some time, and finally made a complete recovery. In 1918, during the epidemic of influenza, he became quite ill and it was several months before he was able to go about the house. Since that time he has never felt perfectly well. Soon after that he developed what was termed asthma and bronchial trouble, and was unable to attend to his business. His condition gradually grew worse, with loss of weight and severe chills, followed by sweats. No pulmonary hemorrhage at any time. In 1921, he was sent to the State Sanatorium, where he was told he did not have tuberculosis, but was advised to seek a warmer climate. X-ray examination of chest, on his return from Sanatorium, revealed much pathology, re-

*From Bronchoscopic Clinic, Mercy Hospital.

sembling either an unresolved pneumonia or empyema of left side. Subsequent treatments proved of little value, and again he remained with an undiagnosed condition, gradually becoming worse and was compelled to keep to his bed the greater part of the time.

In September, 1925, X-ray examination showed the pathology in the left lung greatly increased, suggesting either a massive empyema or an extensive neoplasm. Aspiration revealed no fluid in the pleural cavity. Physical examination was essentially negative except for the thorax, which was as follows:

The thorax was rather emphysematous in type, showing a marked lagging in expansion on inspiration on the left side. Fremitus was entirely absent over the entire left side. The apex beat of the heart was easily found in the sixth interspace about one centimeter to the left of the nipple line, and there was no shock or thrill.

On percussion, the right thorax gave a percussion note that was somewhat dull at the extreme base, with increasing resonance above, going to hyperresonance. The left thorax gave a percussion note that was definitely flat as high as the third rib, with some resonance at the apex. The heart seemed to be slightly enlarged.

The right thorax showed breath sounds that were very clear, although a little distant. There were a few scattered räles at the base posteriorly. The left side showed a complete absence of breath sounds anteriorly, and the fourth interspace posteriorly with some few breath sounds above this level that were distant. The heart sounds were regular, full, clear, rhythmic at the apex and base, and at trifle rapid. Blood pressure was 156 systolic and 122 diastolic.

Under local anesthesia, augmented by a quarter of a grain of morphin hypodermatically, bronchoscopic examination was made. The upper respiratory tract seemed perfectly normal excepting for a mild congestion of the mucous membranes. The right bronchus appeared normal. In the wall of the left bronchus, about three centimeters below the bifurcation, a large mass, apparently growing in the wall of the bronchus, was found to be completely obstructing the inspiration and expiration of air in the left bronchus. The growth was firm,

smooth and not movable, due to size and being firmly impacted in the bronchus.

The pathologic report was nonmalignant fibroma, and at three subsequent bronchoscopies the growth was removed.

He was promptly relieved of severe symptoms and the physical signs in the left chest gradually cleared up.

Case No. 2.—J. B. O'C., age 24 years, occupation teacher, was admitted to the Bronchoscopic Clinic June 26, 1925, complaining of hemoptysis and dyspnea. Family and past history unimportant.

The present illness dates back to October, 1918. Until this time the patient had been perfectly well. Two months before, physical examination was negative. In October of this year he had what was supposed to have been a pulmonary hemorrhage while playing football. He was treated as a tuberculous patient. X-ray examination of the chest was negative. The attacks occurred at irregular intervals until his admission to the hospital. They were characterized by sudden onset, with dyspnea, cough and hemorrhage. Frequent examinations were made, and during this period he was kept under rigid tubercular treatment, although no evidence of the disease was found, except the hemorrhages. In January, 1925, following an attack, he was seen by Dr. M. C. Pincoffs, and a polyp of the right bronchus was suspected.

Physical examination of the patient was entirely negative. The patient was a big, healthy individual, weighing 180 pounds, and looking the picture of health.

With local anesthesia, obtained by using 5 per cent cocain, reinforced by morphin, gr. ¼, a bronchoscopy was done. Three centimeters from the bifurcation of the trachea there was found a small ulcer in the right bronchus, 4 cm. in diameter, covered by a grayish exudate, and the mucosa around the border was deeply congested, fading into normal. The removal of the exudate was followed by bleeding. The ulcer was cauterized with 10 per cent silver nitrate, and, following three subsequent treatments at weekly intervals, the ulcerated area healed promptly. Three months later a bronchoscopy was done, primarily to verify the healing process.

The patient was discharged and advised to continue with his daily work, with all restrictions removed from his taking ex-

ercise and engaging in whatever athletic activity he might desire.

Case No. 3.—Boy, 21 months old, son of a farmer, was found lying near the house, by a member of the family, and appeared to be in a dying condition. He showed no improvement after several hours, and the family physician, suspecting a foreign body, referred him for bronchoscopic examination. Eighteen hours after onset he was admitted to the clinic; temperature 103.2, pulse 160 and respirations 52. X-ray examination was negative. Cyanosis was pronounced and he gave a picture of air hunger, due to obstruction. Immediate bronchoscopy was deemed advisable.

Without anesthesia, a 5 mm. bronchoscope was introduced, and a wheat head, 5 cm. long, was found impacted in the trachea and right bronchus.

The child made a prompt recovery after removal of the foreign body.

7 E. Preston St.

DISCUSSION.

Dr. Wolff Freudenthal, New York: I was interested in the report of these three cases, especially the second one. I have never seen a primary ulceration of the trachea or bronchi. I have seen secondary ulcerations in connection with tuberculosis, that occur in the trachea. If you take the trouble to examine tuberculous cases you will find many ulcers in that region. The question to my mind is: What was the character of this ulceration? It was not tuberculous; it was not syphilitic; what was it? I have seen cases occurring in diabetes. Did this young man have diabetes?

Dr. P. P. Vinson, Rochester, Minn.: At the last meeting of this society I reported a case of tumor of the trachea treated by diathermy. The pathologic report on this tumor was fibrous inflammatory tissue. I thought it would be of interest to show a drawing made at the last bronchoscopic examination in December, 1925. This tumor was treated by diathermy and not by fulguration because of the wide attachment at the base and the fear of postoperative hemorrhage.

Dr. S. Yankauer, New York: I have seen two cases, one in the left bronchus, with all the symptoms of lung abscess.

The tumor did not cause complete obstruction of the bronchus, but it was large enough to act as a valve during expiration. We used punch forceps, but the lung abscess was not cured thereby. We had to give the patient antibronchial treatment. In another similar case, which was like Dr. Zinn's, with obstruction of the bronchus, there was an abscess shadow seen in the lung. This was removed by punch forceps. It was recent, with no suppuration beyond it. The recovery was dramatic and complete. These cases are very interesting, even though they are rare. I have seen a case in which I made a diagnosis of fibroma of the trachea, just above the bifurcation of the trachea. The pathologic report had not been made. I do not know whether this was a third case.

DR. ZINN (closing): In regard to the second case of ulceration of the bronchus, so far as we could make out, the patient was put through a rigid examination, both in New York and Baltimore, and there was no evidence of anything except very profuse hemorrhages. After two weeks in bed this was stopped, but after exercise he had another hemorrhage. At the second bronchoscopy we made smears, which did not show anything of importance. Urine and blood sugar were practically normal. With regard to removal of fibromata, I have found that with the punch forceps you can readily remove them. In my case there was a very large tumor; it could not all be taken out at the same time; hemorrhage was slight following removal.

XXIX.

REPORT OF A CASE OF CYST OF THE THYROGLOSSAL DUCT.

By E. G. Gill, M. D.,

Roanoke, Va.

Thyroglossal cyst and fistulæ may occur anywhere along the course of the thyroglossal tract—namely, from the foramen cecum to the body of the thyroid gland. For purposes of description these locations have been tabulated by Klingenstein[1] and Colp[2] as follows:

1. Beneath the foramen cecum.
2. In the floor of the mouth protruding beneath the chin.
3. Suprahyoid.
4. Subhyoid.
5. On the thyroid cartilage or membrane.
6. At the level of the cricoid.
7. In the suprasternal notch.

When the base of the tongue is formed by the union of two lateral arches, an epithelial lined canal persists, leading from the foramen cecum to the middle lobe of the thyroid. The upper portion of the duct may remain patent (lingual), while the lower region, from thyroid isthmus to hyoid bone, forms the thyroid duct (Ewing[3]).

Patient, R. T. L., male, age 47, consulted me January 6, 1926. Chief complaint: has had choking sensations at times during the past year. This condition is worse when lying down. Patient thinks he has catarrh.

Past history: The symptom began one year ago. During this time the patient has had no difficulty in swallowing and has followed his occupation of a trainman without any inconvenience.

Examination: Nose and accessory sinuses, negative; throat, tonsils apparently clean; laryngopharynx reveals a smooth, rounded pedunculated tumor situated between the base of the tongue and the epiglottis. Physical examination otherwise negative. Laboratory examination, blood Wassermann and

urine negative. Operation: Tumor was seized with a hook and the pedicle was excised with a wire snare. No anesthesia. Patient left the hospital the following day and has since remained well. Dr. C. D. Noftsinger, pathologist, made the following report:

"A cystic tumor, about the size and shape of a partridge egg, measuring about 1¼ inch in one diameter and ¾ inch in the other diameter. There were no adhesions about the tumor. Upon sectioning, the tumor contained a thick milky looking substance which had an offensive odor. Microscopic examination revealed a cystic wall which was lined by several rows of epithelial cells. There was no malignancy found. From the location of this tumor and the pathologic findings I believe it is a thyroglossal cyst."

Cyst of the thyroglossal duct is a rather rare occurrence. W. E. Sistrunk, in discussing a paper by Gessner, in 1913, before the Section on Surgery of the Southern Medical, stated that only thirty-one cases of 86,000 admissions to the Mayo Clinic were diagnosed as thyroglossal duct cysts or fistulæ. Klingenstein and Colp reviewed forty-two cases that were admitted to the surgical wards of the Mount Sinai Hospital from 1913 to 1924.

BIBLIOGRAPHY.

Klingenstein, Percy, and Colp, Ralph: Annals of Surgery, Dec., 1925.
Ewing, James: Neoplastic Diseases, 1922.

XXX.

FOCAL INFECTION FROM THE DENTAL STANDPOINT.*

By Earle C. Rice, D. D. S.,

Philadelphia.

Focal infections, associated with the dental tissue, are known to be causative factors in the more or less serious maladies which the physician is called upon to investigate.

The whole hearted cooperation that has come to pass between the professions of medicine and dentistry, has opened the way for exhaustive study of the relationship of dental foci of infection to every organ and tissue of the body.

In time past, the dentist gave little heed to the general health of the patient, except to furnish him with as many functioning and comfortable teeth as his mechanical skill and therapeutic knowledge would permit. Many ghastly conditions were often allowed to exist because there seemed to be no remedy except extraction, and this measure was adopted as a last resort, where freedom from pain could not be otherwise accomplished.

In 1910, Sir William Hunter presented the matter of oral sepsis so convincingly that the tide was turned, and a happy outcome seems inevitable.

Let us consider these foci of dental infection that have their origin in the dental pulp, and, as a background to the picture, briefly review the psysiology and minute anatomy of that organ.

The dental pulp is a vascular, cellular, neural organ. Its office is to build the dentine or body of the tooth, which it does from without inward, through the functional activity of the odontoblasts. As the work of building progresses, and the dentinal wall grows thicker through the deposit of calcoglobulin, the odontoblasts recede and leave in their wake fine fili-

*Read by invitation, as a part of a symposium on Focal Infection, at a meeting of the American Laryngological, Rhinological and Otological Society, May 31, June 1 and 2, 1926.

form prolongations of their bodies, known as dentinal fibrils. When the dentine is fully formed, these fibrils are seen to penetrate the entire dentine radially from the long axis of the pulp chamber and root canal, and each fibril is connected with its fellow by many decussating fibrils. We now picture the dentine as a mass of calcoglobulin, enmeshed in a vast arborization of protoplasmic fibers terminating in the lining of the pulp chamber.

The vascular and neural elements of the pulp now occupy a very constricted chamber, the arteries and nerves entering, and the veins having their exit through one or more minute foramina at the apex of the root.

The pulp has now built itself a nest, and has nothing further to do but protect itself. It is not a tactile organ, and has no sense of location. Therefore, when attacked by disease, it generally gives sensory expression of its discomfort by reflected pains throughout the ramifications of the fifth cranial nerve.

If a tooth be attacked by dental caries, the pulp, although not actually exposed, frequently becomes infected through the dentinal tubules, and the organisms gain access to the pulp chamber, setting up hyperemia. The arteries are dilated, and in the minute and unyielding apical foramen, impinge upon the weaker walled veins, and the socalled throbbing toothache begins. The tooth responds painfully to changes of temperature. Nature never intended that teeth should decay or pulps become infected. She, therefore, did not supply the pulp with a lymphatic system to take care of the effusions of inflammation, ergo, the pulp is permanently infected. The pulp may later, according to the grade of inflammation that follows, become strangulated and gangrenous.

Pulps of noncarious teeth may become infected, strangulated and even putrescent.

The dental pulp may become necrotic, and remain so for a long period. Periapical infection may result, and the tooth still be symptom free, remaining so indefinitely.

It is needless to go into the details of root canal instrumentation. We know from clinical experience that no method of procedure can give definite assurance that these pulpless teeth are free from infection and in turn are not directly responsible for other maladies.

It is significant in the extreme to note that thousands of teeth that are symptom free, and that are roentgenographically negative, are being examined in the bacteriologic laboratory after extraction and found to be infected. In view of this, we are eminently justified in viewing all pulpless teeth with grave suspicion.

The conservative dentist will say, "This patient is in good health, the pulpless teeth are symptom free, and roentgenograms are negative. Why, then, sacrifice the teeth?" On the face of it, the reasoning seems sound, but on second thought, shall we retain these teeth until a myocardial disturbance puts in an appearance, or a cholecystitis, a rheumatoid arthritis, an iritis, a corneal ulcer, renal canculi, and so on, or shall we practice prophylaxis and remove the suspicious teeth?

It is not possible to determine whether a pulpless tooth in the mouth is or is not sterile. Men of high professional standing have wrestled with the problem, but the result of their splendid effort has been far from satisfactory, since the proof of the work can only be accomplished after extraction.

It is known beyond the peradventure of doubt that dental foci of infection are among the most active agents that militate against bodily well being, and graveyards are filled with their victims.

The roentgenogram is an indispensable adjunct in diagnosis, but its limitations must be carefully considered.

Prophylaxis is the highest type of medical service, and a courageous application of the principles it involves holds out to the laity an assurance of longer life and greater comfort.

1523 Locust St.

SOCIETY PROCEEDINGS.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

Meeting of Monday, October 4, 1926.

THE PRESIDENT, DR. ARTHUR M. CORWIN, PRESIDING.

PRESENTATION OF INSTRUMENTS AND SPECIMENS.

Two White Mice With Tar Cancers.

DR. GEORGE W. BOOT presented two white mice with tar cancers, and stated that the animals developed papillomas before the appearance of the epitheliomas. His wife had recently died from cancer of the stomach, and two or three years before there were any signs of this disease she developed numerous papillomas on the backs of the hands and neck. With this fact in mind, and the fact that the mice developed papillomas before they developed epitheliomas, he thought of a possible connection. Two or three weeks previously he had been consulted at the Cook County Hospital by a police sergeant who had cancer of the throat. He asked this patient if he had had any warts and found that he had about dozen on the palms, which had been present for two or three years. In one other case of cancer in the hospital the patient had one wart on the hand. In the wards he found quite a number of other cases, and about half of the patients had developed groups of small warts before they had any symptoms of cancer. A private patient with cancer of the tongue stated that groups of warts had developed every summer for three or four years. Dr. Boot felt certain that there is a relationship between the groups of small warts and the development of carcinoma, and expressed a desire to have the members of the Society keep this point in mind and make a record in every case.

DISCUSSION.

DR. JOSEPH C. BECK recalled an article which he had published in the Laryngoscope several years ago, in which he reported on the work of Buxbaum in injecting toluylene red yeast into animals and producing carcinoma. He felt that

there was no question that following the introduction of the red yeast into the animals cancerous tissue developed. Following the statement that this was only an animal experiment and that mice and fowl easily develop cancerous tissue, a young Russian boy who was assisting Dr. Beck in the laboratory became so incensed at this attitude of doubt concerning the work of his master that, without the knowledge of anyone, he injected some of the toluylene into his leg. Within five weeks he developed a lump in the leg. They were greatly shocked that he had done this thing, but the boy said, "What do I amount to if I can't disprove this statement regarding the work of my master?" A judge was consulted as to what had best be done, and he ruled that the lesion should be removed. This was done and the boy had never developed any growth at the site of the lesion, although it was very much like those in the animals. Dr. Beck thought these cancers might be similar to the chimney sweep's cancer, which produces an epithelial growth, or a paraffinoma, which contains carbon particles, which will stimulate epithelial growth and produce the lesions. He considered Dr. Boot's work very interesting.

DR. BOOT (closing) said that he had failed to get any ulcers or papillomas in the white rats, although he had treated them in the same way. He did not believe the growth referred to by Dr. Beck was a carcinoma, for he said it was encapsulated.

Laryngeal Carcinoma.

DR. AUSTIN A. HAYDEN presented a specimen of a laryngeal carcinoma, which had been removed from a man who for eighteen months had had slight difficulty with his voice. He was first seen by Dr. Hayden about the first of August, 1926, and for several weeks previously he had been very dyspneic. He had received deep roentgenotherapy externally, some of the treatments having been given by a chiropractor in Little Rock, Arkansas. When Dr. Hayden first saw him he had a very large extrinsic swelling over the larynx, which had been opened just through the skin. He was immediately sent to the hospital. The dyspnea became so acute shortly after his arrival there that an emergency tracheotomy was done, with relief for about ten days. At the end of that time he was called by

the intern about 2 a. m., and told that the man had had a hemorrhage and died. The hemorrhage started somewhere above the tube and the man suffocated in his own blood before anything could be done.

The interesting feature of the case was the complete absence of metastases anywhere in the body, upon complete necropsy by Laurence H. Hines, pathologist at St. Joseph's Hospital. The man was apparently in perfect health aside from the laryngeal growth, which indicated that there are many things that are not yet known about the toxemias of malignancy. The patient had been seen by Dr. Theobald four months earlier, after which he returned to the chiropractor in Little Rock.

Edema of the Larynx.

Dr. George W. Boot presented a specimen of edema of the larynx. The patient had been operated upon by a general surgeon for goiter. Following the operation he did well for several days, then became intensely jaundiced and died from obstruction of the larynx. The specimen which was removed at necropsy showed marked edema of the larynx.

DISCUSSION.

Dr. Walter H. Theobald stated that he saw the patient whose case was reported by Dr. Hayden on one occasion about three months earlier. The man was thirty-eight years old and complained of hoarseness of one year's duration. His temperature was 99° F. and he had some cough. Examination showed an involvement of the entire left side of the larynx. The posterior third of vocal cord was ulcerated, and this condition extended below the vocal cord. There was a marked edema of the epiglottis and the arytenoid on the left was not movable. The right vocal cord approximated the left beyond the midline. Because of the long duration of his trouble and the slight rise in temperature, Dr. Theobald suggested a general examination. This was carried out by two men, who said it was a tuberculous affair. Previous to this a diagnosis of syphilis had been made, and the man received ten or twelve injections of neoarsphenamin, although at no time was the Wassermann reaction positive. He saw the patient on one occasion after he came into Dr. Hayden's hands and the tracheotomy had been done. At that time he was comfortable and hopeful, and

expected to have a complete laryngectomy performed. The next time he heard about the case the patient had died from the hemorrhage reported by Dr. Hayden.

Dr. Joseph C. Beck said that the great hope of the radiologists was that the use of radiotherapy would prevent metastases. He had been unfortunate in having to see many of these cases, and all of the cases treated by radium and roentgen ray had followed about the same course. He felt that the toxemia and cachexia in these cases were not due to the carcinoma alone, but also to the radium and roentgen ray toxemia, which it produced by the constant absorption of the necrotic material that follows the massive death of tissue resulting from radiotherapy. These patients develop radiophobia, fear of the symptoms of radiotoxemia, from the absorption of the poisons following the death of the tissues. Not only the carcinoma but the normal tissues also are destroyed in the vicinity where the radiotherapy acts.

Dr. George F. Fiske asked if in this case, with no signs of metastases, a complete laryngectomy would have given any chance of complete recovery.

Dr. Joseph C. Beck thought that if a suction apparatus had been immediately available the man's life might have been saved.

Dr. Austin A. Hayden (closing) said he was waiting for the man's physical condition to improve before attempting a laryngectomy, and the hemorrhagic termination was absolutely unexpected. A complete laryngectomy would have been done a little later.

As to the possibility of preventing such a death by means of suction, this could not always be done. An apparatus was at the bedside. The nurse and the man's wife were in the room with the patient, the wife sleeping, when the man coughed violently once or twice, expelling a quantity of blood from the tracheotomy tube. The suction machine was started at once, but in spite of this he passed away. He believed that probably a considerable amount of blood had trickled down into the trachea and lungs before the man awoke, for he had been sleeping for an hour or so, up to the time the coughing started. He had received an opiate about three hours before, which may have lessened the tracheal sensitivity.

Pork Bone Which Had Been Removed From the Larynx

DR. HAYDEN then presented a piece of a pork bone which had been removed from the larynx of a patient who, while eating a roast pork sandwich, suddenly felt a sticking pain in the neck.

DR. GEORGE W. BOOT expressed the belief that there must be something more than absorption from dead tissue that brought about the toxemia in the patients treated by radiotherapy. Only a small amount of growths are destroyed in this way, but the toxemia is present in all cases.

Referring to the foreign body exhibited by Dr. Hayden, Dr. Boot said he was recently called to see a patient who had been eating macaroni. The man had fallen several years ago and fractured the cervical vertebræ, and it was impossible to get a laryngoscope in place, either with or without an anesthetic. As he awoke from the anesthetic, however, he vomited and expelled a piece of meat as large as the end of a thumb.

"Auscultation and Percussion in the Diagnosis of Accessory Nasal Sinus Disease."

BY AUSTIN A. HAYDEN, M. D.

ABSTRACT.

Inasmuch as sound travels better in a dense media, a vibrating tuning fork held on the forehead (all other things being equal) should be heard longer (duration) and louder (intensity) through a sinus filled with fluid (blood, serum or pus) or solid material (bone and thickened tumor tissue) than through its normal air containing fellow of the opposite side, just the same as the approach of a train of cars can be heard louder (intensity) and earlier (duration) through the rails than through the air; conversely, just as an alarm clock under a bell jar becomes fainter as the air is exhausted, theoretically a "vacuum" sinus should transmit sound waves less readily than the normal sinus filled with air at atmospheric pressure.

Certain sources of error must be guarded against—the tuning fork and stethoscope must be held with firm, even pressure, the former always in the exact sagittal plane of the head, and the latter equally and symmetrically over each antrum, frontal or mastoid, as the case may be. With a little experience, differences in intensity can be readily detected. Throwing the lever back and forth quickly is essential for accurate comparisons,

as the sound intensity of even a ninety second fork fades away with surprising rapidity. Sound duration is difficult to determine. However, with a little experience, an average of not less than three tests should reduce this source of error to about 10 per cent; consequently, only differences greater than this should be considered significant. If the observer's own hearing is defective, suitable allowances should be made. Extraneous noises should be excluded as far as possible, and the tuning fork struck with equal force as nearly as may be.

Diseased antra and frontal sinuses in the majority of the cases reported auscultated louder and longer, as did sclerotic and acutely inflamed mastoids when compared with an opposite pneumatic normal side.

The percussion impact of the observer's clenched fist on the top of the patient's head is felt distinctly in the acutely diseased sinus or tooth pulp.

Conclusions: It would seem fair to state that auscultation and percussion may become procedures of value in the diagnosis of accessory nasal sinus disease. They are purely objective symptoms. The evidence that they can be expected to furnish will be only corroborative, but nevertheless worthy of consideration if the observations of others confirm what has been set forth here.

DISCUSSION.

Dr. Albert H. Andrews expressed his pleasure at hearing Dr. Hayden's paper, because some years ago he was interested in the same line and made some observations, especially on the mastoid. This was before the days of the roentgen ray and before transillumination was the rule. These things he felt had made auscultation of the mastoid unnecessary, and offer a much better means of diagnosis.

Referring to the difficulties mentioned by Dr. Hayden, not having had any experience with the method, the difficulties Dr. Andrews saw were only theoretical. He believed Dr. Hayden would experience difficulty in getting patients to place the two bells of the stethoscope in the same way, with the same amount of pressure, and thought he should arrange some mechanical means of placing the bells and regulating the pressure.

In regard to the time during which the vibrations can be heard, there would be the same trouble as with the mastoid. If the fork was placed on the head and immediately held tightly against the head, the sound would be heard by bone conduction only two-thirds as long as if it were started and permitted to run for a time before being placed on the head. If the sound disappeared for a moment, by making deeper pressure it would be heard again.

Dr. Andrews expressed his gratitude to Dr. Hayden for calling attention to this means of diagnosis, and said he would immediately start making such examinations, using ordinary soft rubber tubes until he could get the apparatus described and presented, compressing the tubes with his fingers.

In his work, several years ago, he became interested because with a patient sitting before him in the clinic one day he wondered what was going on in the mastoid. He placed the bell of a small stethoscope on the tip of the mastoid and the handle of a tuning fork above it, and found that the sound on the diseased side was much louder than on the opposite side. After considerable experience with the test he decided it was a good means of determining whether the sinus was filled or empty. He was also able to determine by this means whether the lateral sinus was well back or forward. As soon as the tuning fork passed over the lateral sinus to the mastoid the sound became very much louder. Another experiment which was made, but which he did not think he originated, was that of placing the ordinary auscultation tube in the patient's ear, the operator listening to the tuning fork and then comparing it with the other side. He found in this way that the sound was much plainer on the affected side.

Dr. Robert Sonnenschein thought that no matter how honestly a man might do his work, or how earnestly he searched the literature, he might find after publication that the work had been done before. He was reminded of this about a year ago when he found an article of only ten or twelve lines by Bonnier of Paris, who presented before the International Congress, in 1899, a procedure which was very similar to the one Dr. Sonnenschein had proposed for using the fork stem for both air and bone conduction. Some years ago, when

the Canfield-Sturman operation was devised, both workers published the method in different journals at about the same time.

Dr. Sonnenschein was surprised to find that the patient heard the sound only about the same length of time by air conduction as with bone conduction, and believed he should have heard it longer. Bezold found that if he placed a tuning fork on the head of an individual, by means of a stethoscope on the head the observer would hear the sound ten to twelve seconds longer than the examined person. This was supposed to be a frank illustration of the fact that air conduction is better than bone conduction. In a thick walled tube the sound waves do not go through the wall of the tube but through the lumen, and the individual hears by air conduction.

He agreed with Dr. Hayden that it was very important to keep the tuning fork in the midline of the head. If it is even a little to the left the sound will be heard more readily on the right side of the head and vice versa, and whether one is making the examination of the sinus or otherwise, care must be taken to keep the fork in the midline. The fork Dr. Hayden used sounded only thirty seconds, and it was necessary to switch from one side to the other quickly because the tone dies down so soon. Dr. Sonnenschein thought it would be well to use the Edelmann, or some other good fork, which will vibrate as a rule from 120 to 180 seconds and can be heard by bone for ninety seconds. In this way one would have no difficulty in having the sound continue long enough, even if the lever were not switched so rapidly from one side to the other.

Dr. Albert H. Andrews called attention to the difference between originality and priority, and said that many individuals do things that are original with them that may have been done hundreds of thousands of times before. Knowing nothing about this, the person is doing original work. He thought he was safe in saying that while he had done some original work, he had never claimed priority in anything, for if one goes back far enough in the literature he will doubtless find that the same work has been done before.

Dr. George W. Boot asked if Dr. Hayden had tried the method out on any patient with one frontal sinus absent, and, if so, what was the result.

DR. J. HOLINGER said that in the auscultation in one case the pitch seemed to be changed. This was a frequent observation. While the loudness changed it seemed that the pitch had changed. The unaffected side sounded from half a tone to a full tone higher, and he thought this should be borne in mind.

Referring to the closure of one side of the nose, he thought it natural that the closed side should sound louder. It was not a question of more or less air going through, but a question of conduction of sound. A partially closed nose will conduct sound better, although not so much air will go through.

DR. ELMER L. KENYON thought that if a patient was nervous he might hold the lower jaw firmly against the upper, and in that way change the vibration. He believed it would be wise to have the mouth held slightly open in making the test.

Dr. HAYDEN (closing), in reply to Dr. Sonnenschein, said he thought he had observed that it was considerably easier to tell the difference in loudness when the sound was fairly large than when the tuning fork was ceasing to vibrate. For this reason he thought that the rapidity with which the little lever could be moved back and forth in comparing the sounds was quite important.

He expressed his gratitude to both Dr. Sonnenschein and Dr. Holinger for the suggestion that a longer duration type of fork might improve the accuracy of the results. As to making the examination with the mouth open, as Dr. Kenyon suggested, he had not tried this, but had noted that an abscessed tooth in the lower jaw did not respond as accurately to percussion in registering soreness as one in the upper jaw. The upper jaw being a continuous plate of bone, the vibration was transmitted very easily. The lower jaw did not transmit so easily, except when firmly fixed against the upper.

There had been no cases available in which the frontal sinus was absent.

Dr. Hayden expressed his regret at not having known of Dr. Andrews' previous work, and said that if he had had the advantage of his experience he could have written a much better paper.

DR. ARTHUR M. CORWIN, DR. JOHN A. CAVANAUGH and DR. ROBERT SONNENSCHEIN addressed the Society on "Otolaryngologic Items of Interest from Abroad."

CONTENTS—Continued from Second Cover Page.

XVII.—The Anatomic, Pathologic and Clinical Relationship of the Posterior Sinuses to Optic Neuritis. By Claude G. Crane, M. D., Brooklyn 201

XVIII.—Treatment of Atrophic Rhinitis by Ivory Implants: Presidential Address. By Harry L. Pollock, M. D., Chicago 241

XIX.—Address of the President, American Bronchoscopic Society, 1926. By William B. Chamberlin, M. D., Cleveland 248

XX.—Bronchoscopy in the General Hospital. By M. C. Myerson, M. D., Associate Laryngologist, Mt. Sinai Hospital, New York 253

XXI.—Bronchoscopic Pharyngeal Suction Tube. By M. C. Myerson, M. D., New York 259

XXII.—A New Esophageal Bougie. By M. C. Myerson, M. D., New York 261

XXIII.—Multiple Cysts of the Lung. By William Frederic Moore, M. D., Philadelphia 263

XXIV.—Continuous Endobronchial Aspiration for Drowned Lung Complicating Eclampsia. By William F. Moore, M. D., Philadelphia 270

XXV. Bronchoscopic Lipiodol Instillation Tubes. By Gabriel Tucker, M. D., Philadelphia 272

XXVI.—A Bronchoscopic Bead Forceps. By Gabriel Tucker, M. D., Philadelphia 274

XXVII.—Report of Two Cases of an Open Safety Pin in the Trachea. By Henry Hall Forbes, M. D., New York 276

XXVIII.—Report of Three Cases: (a) Fibroma of the Left Bronchus; (b) Ulcer of the Right Bronchus; (c) Foreign Body in the Trachea and Right Bronchus. By Waitman F. Zinn, M. D., Baltimore 278

XXIX.—Report of a Case of Cyst of the Thyroglossal Duct. By E. G. Gill, M. D., Roanoke, Va. 283

XXX.—Focal Infection From the Dental Standpoint. By Earle C. Rice, D. D. S., Philadelphia 285

Society Proceedings 288

Meeting of the Chicago Laryngological and Otological Society, Monday, October 4, 1926. The President, Dr. Arthur M. Corwin, Presiding. Presentation of Instruments and Specimens. Two White Mice With Tar Cancers—Laryngeal Carcinoma—Edema of the Larynx—Pork Bone Which Had Been Removed From the Larynx—"Auscultation and Percussion in the Diagnosis of Accessory Nasal Sinus Disease" 288